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ALL ABOUT COMPUTERS

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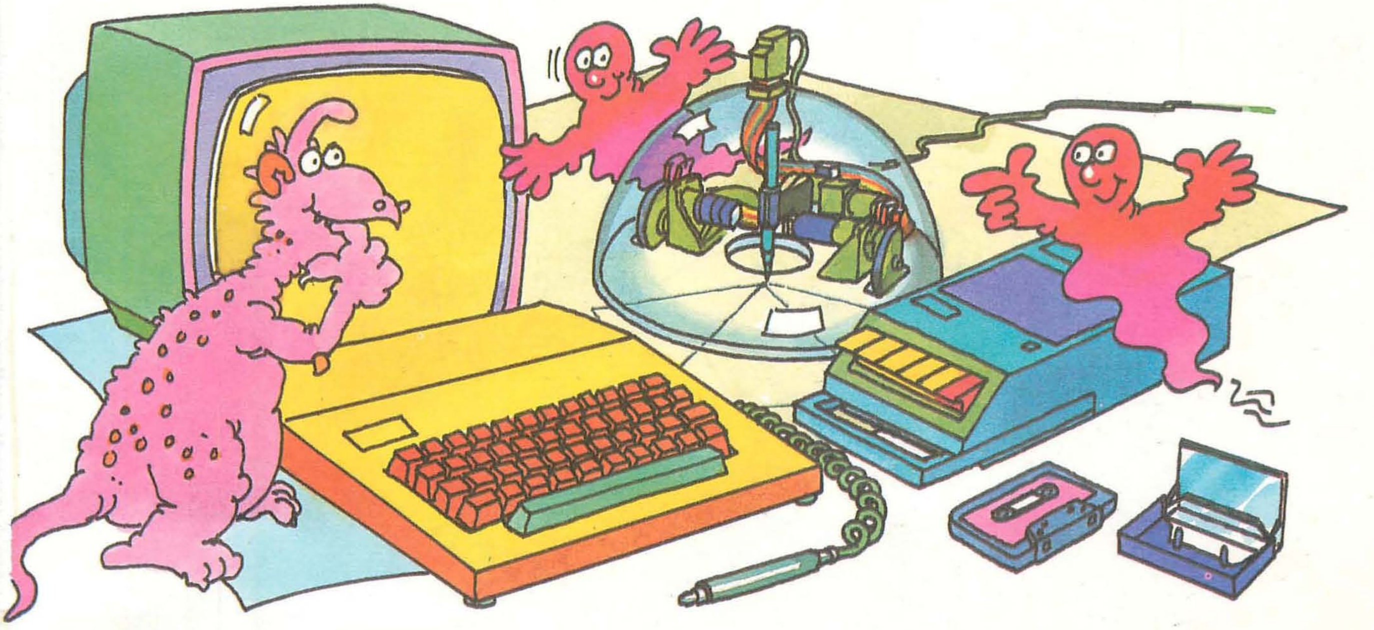
ALL ABOUT COMPUTERS

Helen Davies

Illustrated by Graham Round



Programs written by
Robert Schifreen, Nick Tatchell and Paul Shreeve

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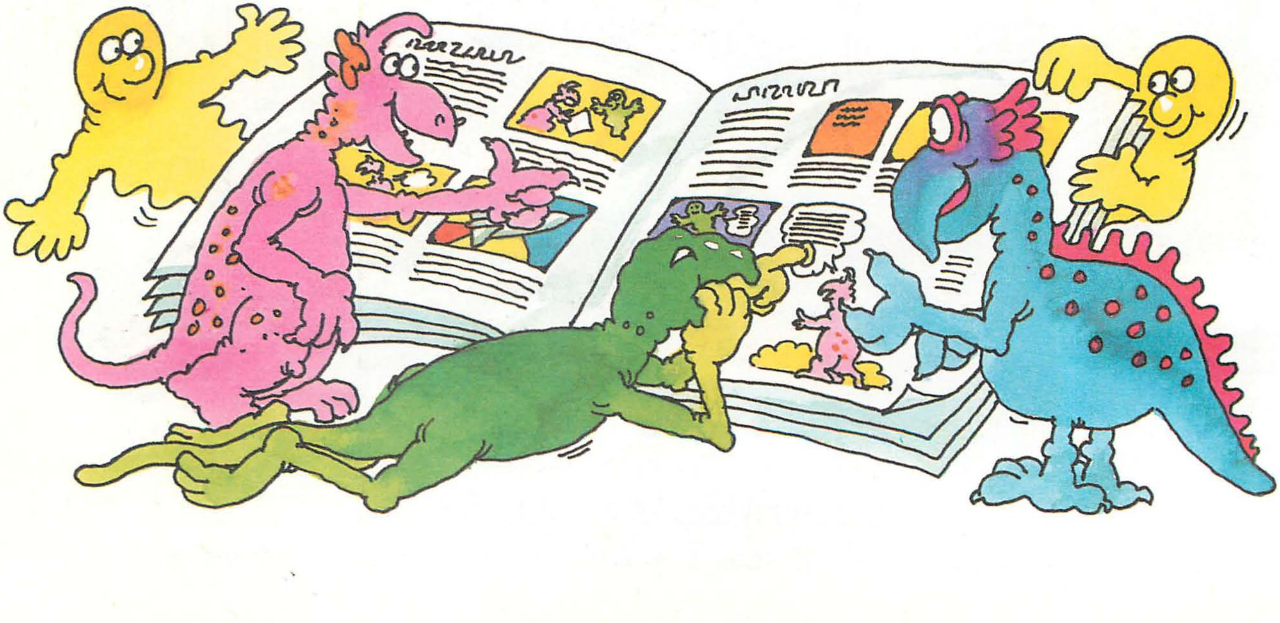
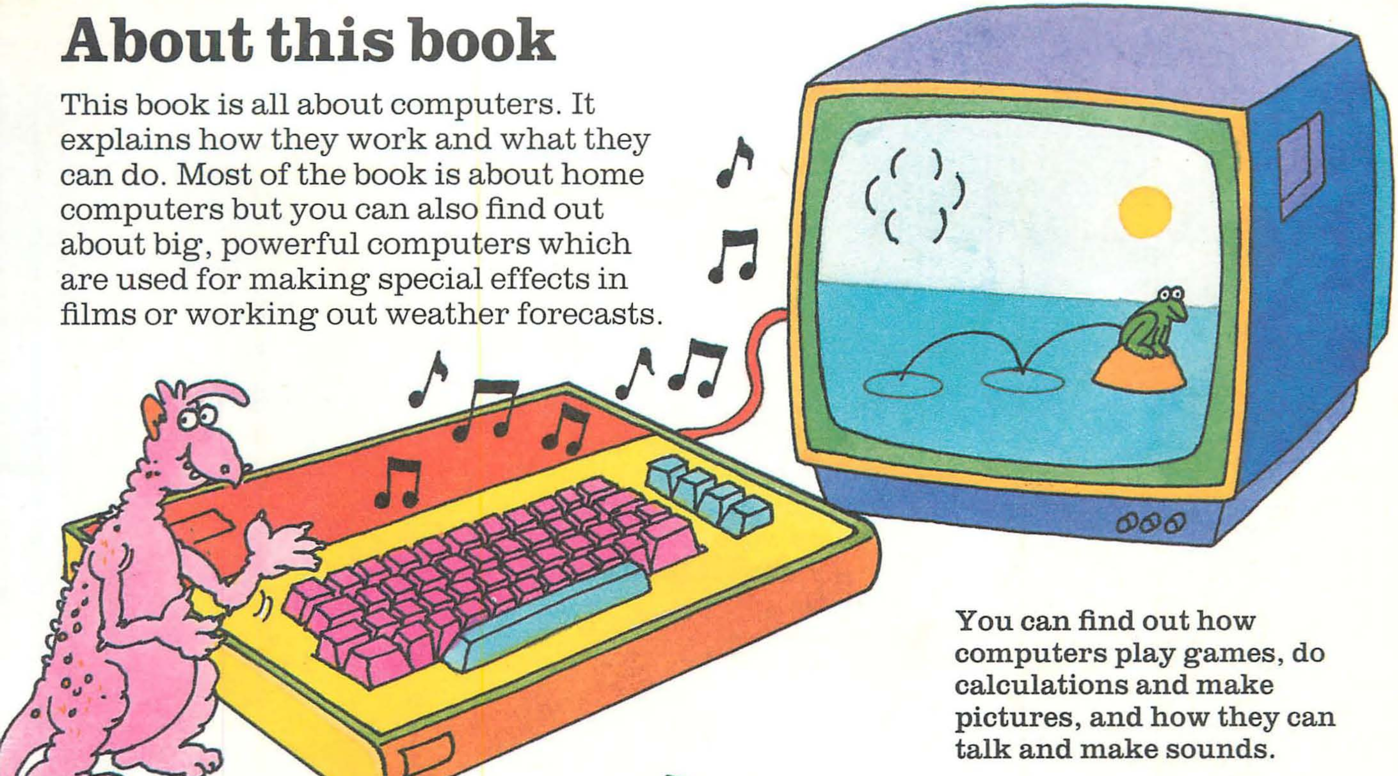
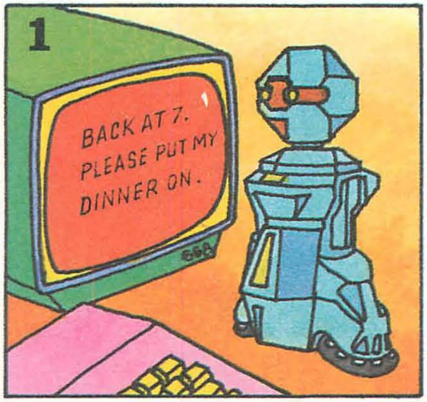


About this book

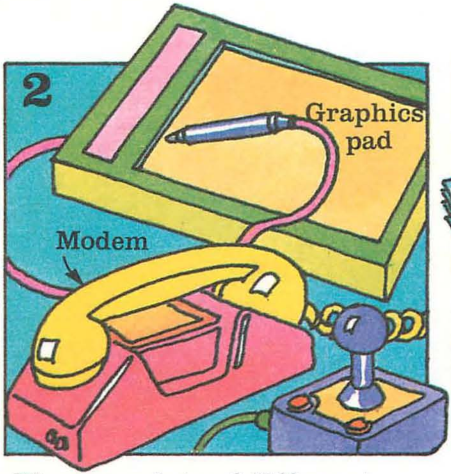
This book is all about computers. It explains how they work and what they can do. Most of the book is about home computers but you can also find out about big, powerful computers which are used for making special effects in films or working out weather forecasts.



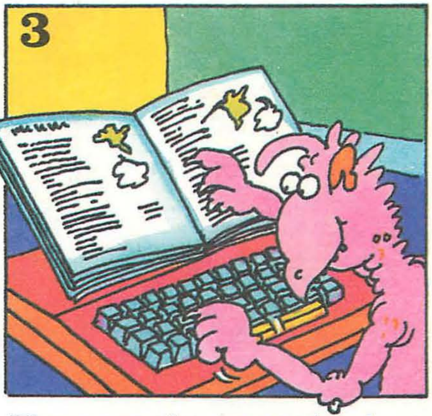
You can find out how computers play games, do calculations and make pictures, and how they can talk and make sounds.


1
BACK AT 7.
PLEASE PUT MY
DINNER ON.

You can also read about robots, and electronic mail – a way of sending messages between computers in different towns or on opposite sides of the world.



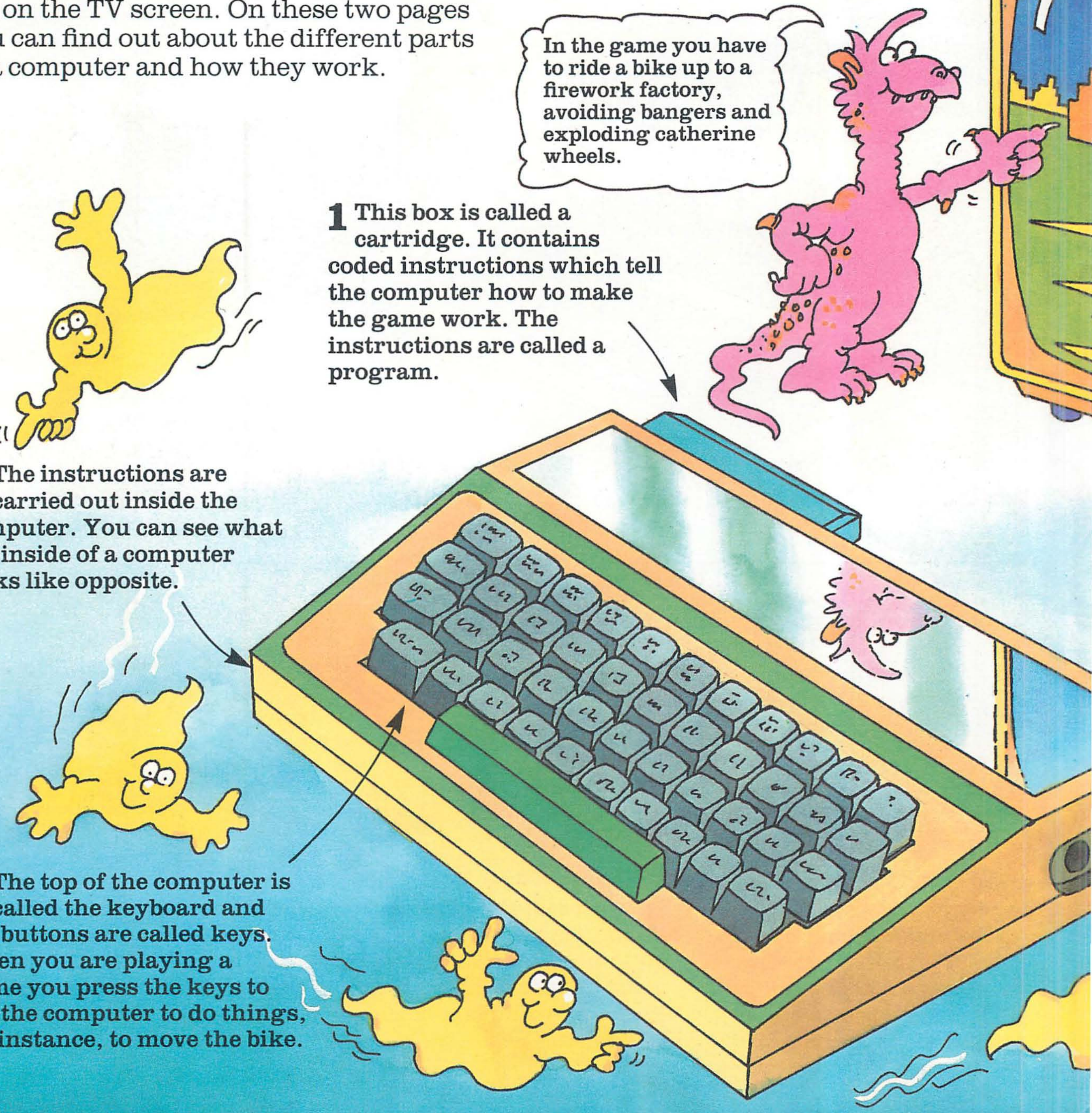
There are lots of different kinds of equipment you can plug into a home computer to make it more useful and fun. You can find out about these things later in the book.



There are also some simple programs to type in and try on a home computer. On pages 32-33 there are tips and hints on typing in programs.

A home computer

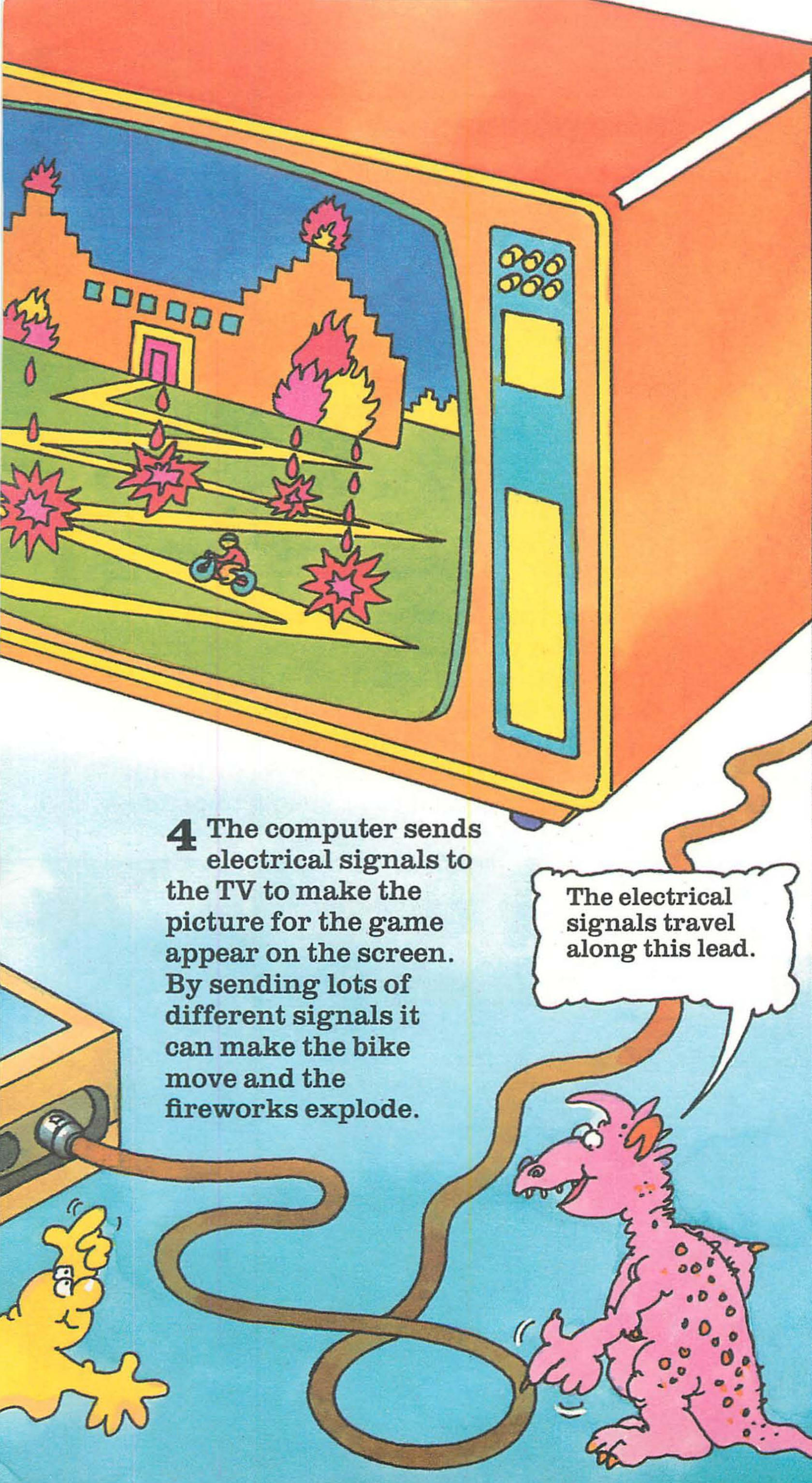
This is a picture of a home computer. It is running a computer game which you can see on the TV screen. On these two pages you can find out about the different parts of a computer and how they work.


In the game you have to ride a bike up to a firework factory, avoiding bangers and exploding catherine wheels.

1 This box is called a cartridge. It contains coded instructions which tell the computer how to make the game work. The instructions are called a program.

2 The instructions are carried out inside the computer. You can see what the inside of a computer looks like opposite.

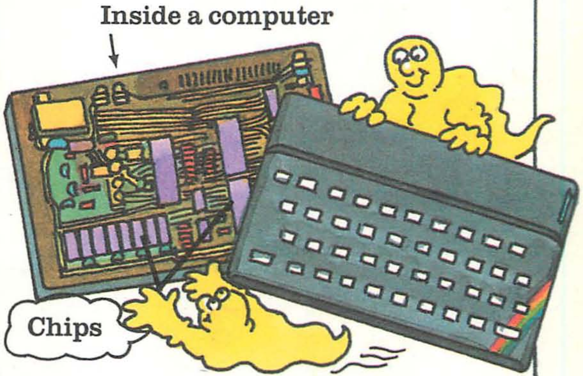
3 The top of the computer is called the keyboard and the buttons are called keys. When you are playing a game you press the keys to tell the computer to do things, for instance, to move the bike.


The electrical signals travel along this lead.

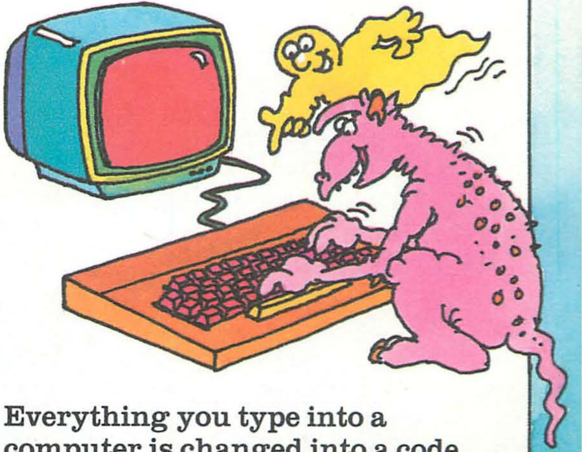
4 The computer sends electrical signals to the TV to make the picture for the game appear on the screen. By sending lots of different signals it can make the bike move and the fireworks explode.

How a computer works

A computer is an electronic machine, like a radio or TV. That means it uses electricity to do its work.


Inside a computer
Chips

This picture shows the electronic parts in a computer. The little boxes are called chips. Each chip has a different job to do. You can find out more about these jobs on pages 14-15.

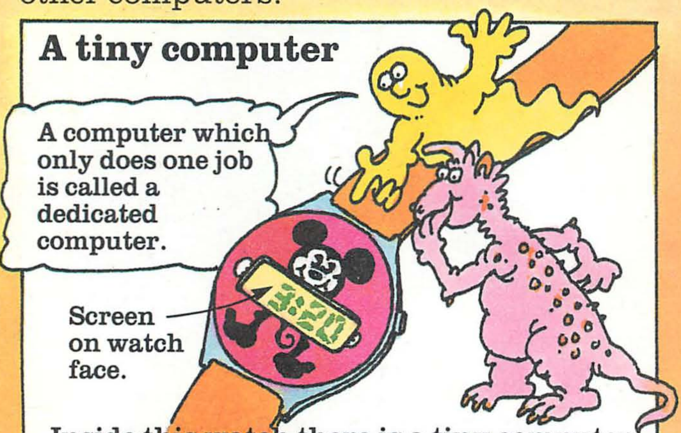


Everything you type into a computer is changed into a code of electrical pulses. The chips use this code to send messages and do all their work.

Other kinds of computers

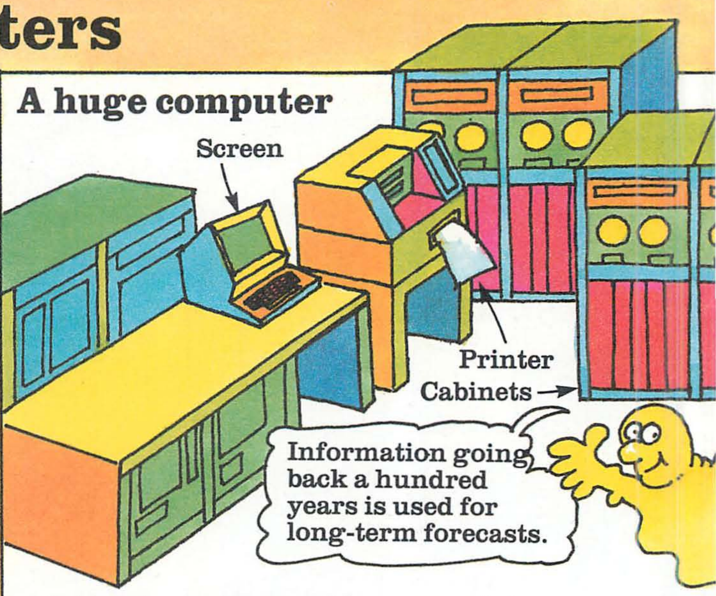
The proper name for a home computer, like the one shown on the last two pages, is a microcomputer. Computers can be lots of different shapes and sizes and do all kinds of different jobs. Here are some other computers.

A tiny computer


A computer which only does one job is called a dedicated computer.
Screen on watch face.
3:20

Inside this watch there is a tiny computer. It measures the hours, minutes and seconds and displays them on the watch face. The working parts of this computer are all on one chip inside the watch.

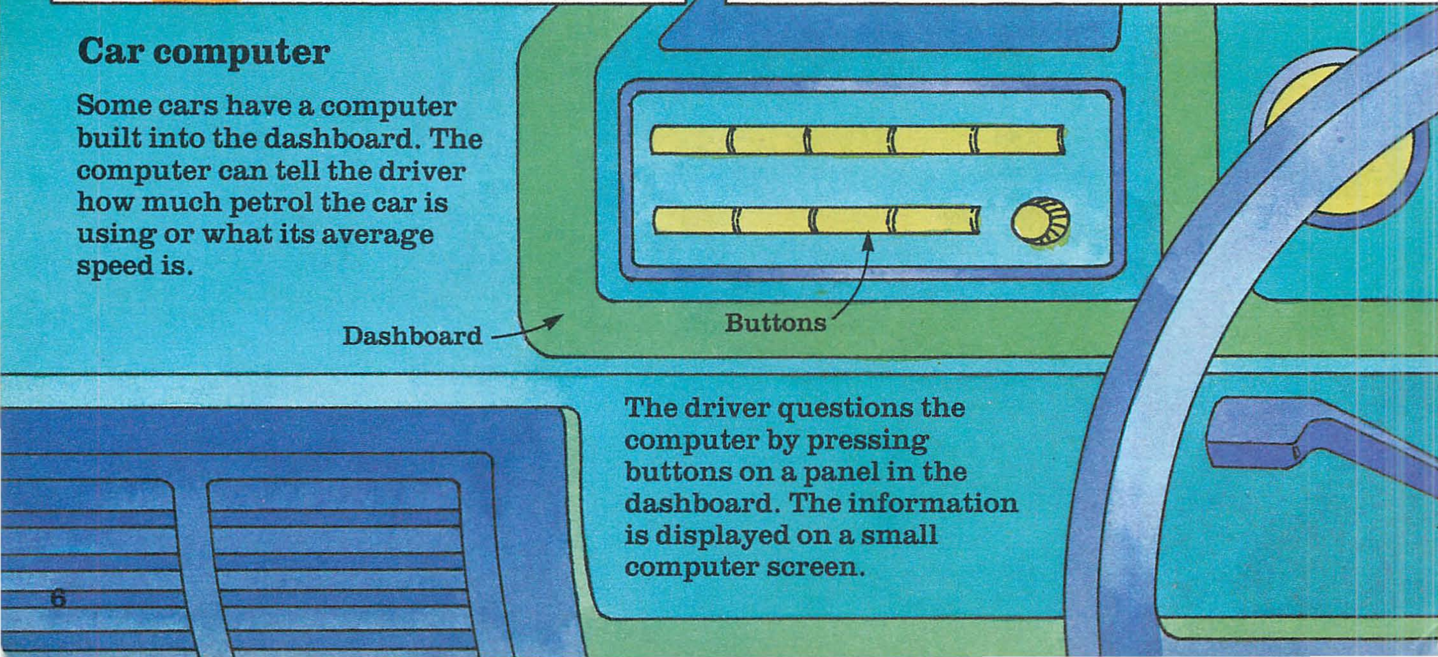
A huge computer


Screen
Printer
Cabinets
Information going back a hundred years is used for long-term forecasts.

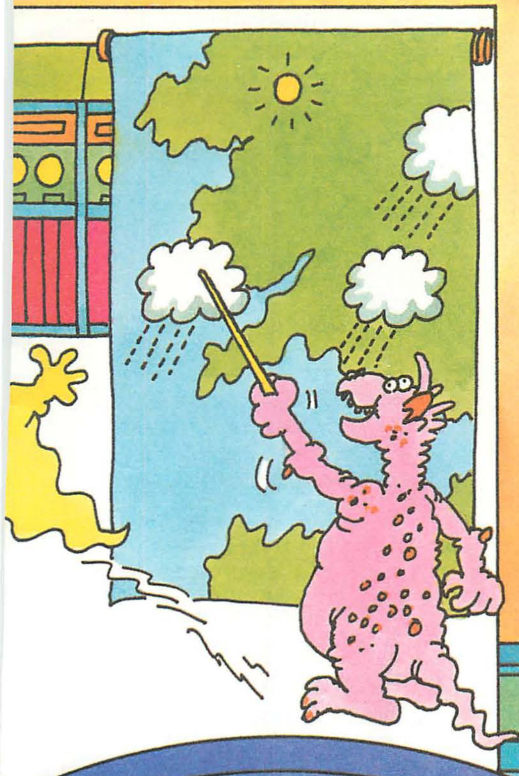
This picture shows a big, powerful computer called a mainframe. It stores information and uses it to work out weather forecasts. A mainframe is made up of cabinets which contain hundreds of chips. It can have lots of keyboards and screens connected to it, so lots of people can use it at once.

Car computer

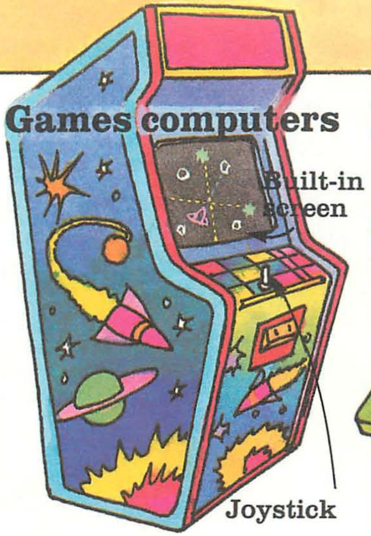
Some cars have a computer built into the dashboard. The computer can tell the driver how much petrol the car is using or what its average speed is.


Dashboard
Buttons

The driver questions the computer by pressing buttons on a panel in the dashboard. The information is displayed on a small computer screen.

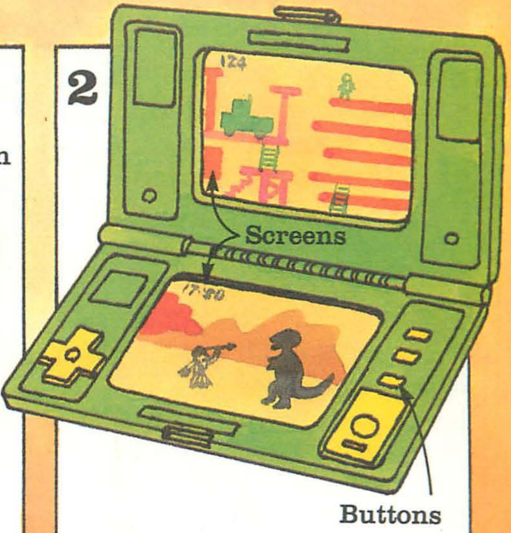


1 Games computers


Built-in screen
Joystick

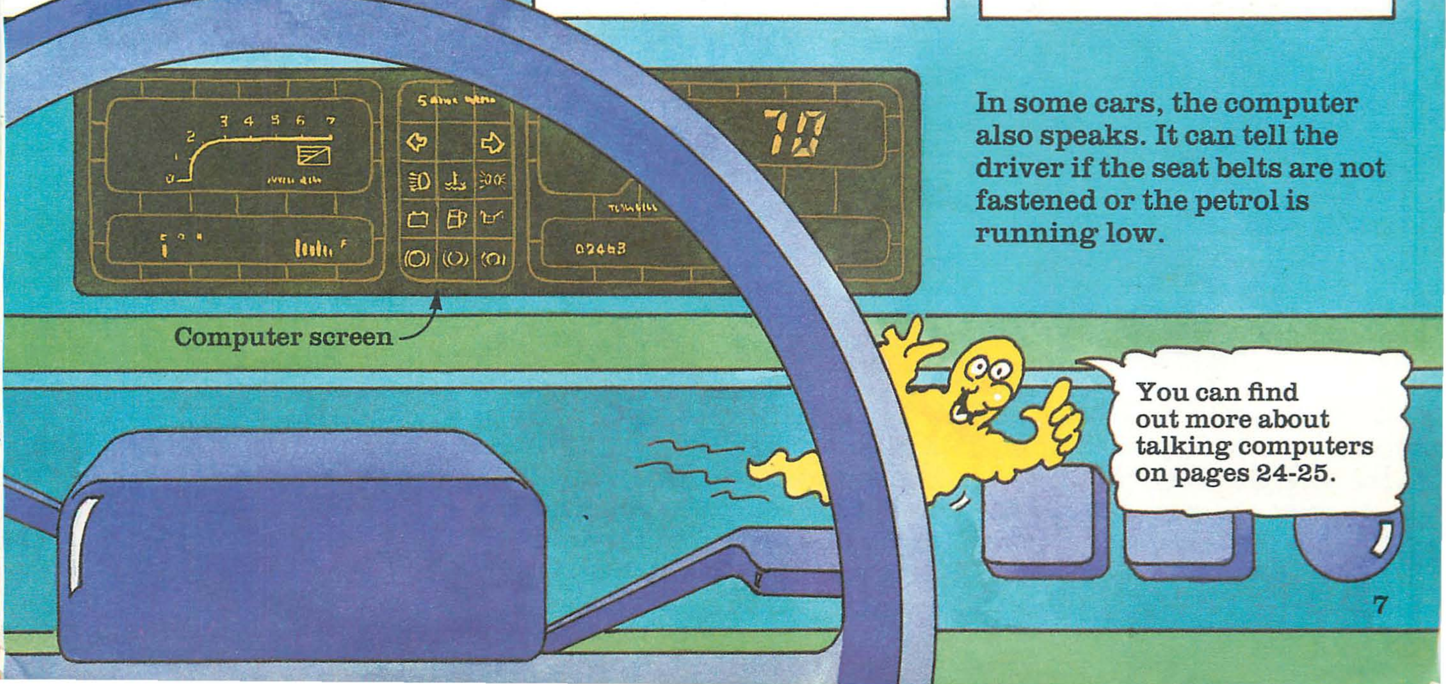
An arcade game is a kind of computer. It has a joystick for moving things on the screen and buttons for firing missiles.

2


Screens
Buttons

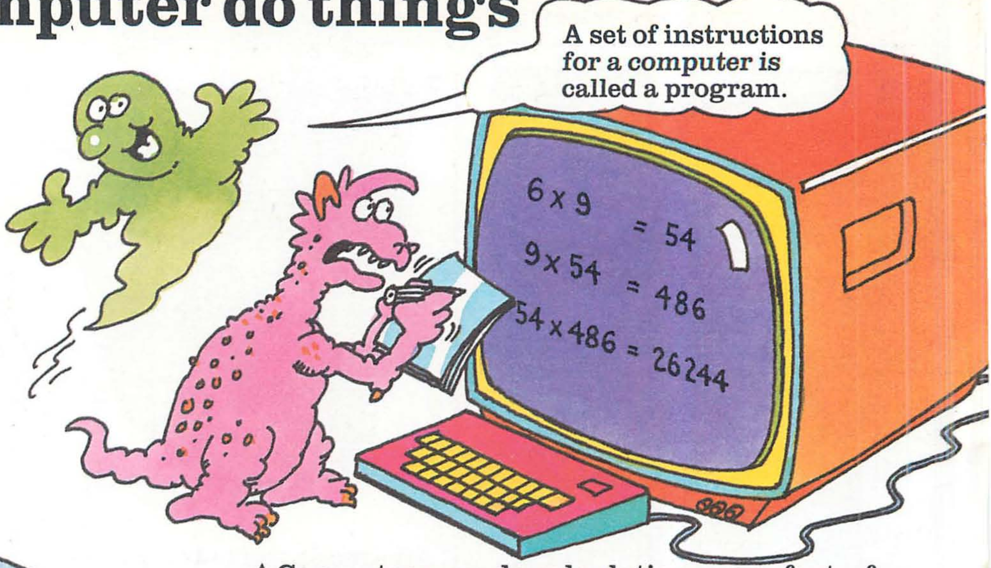
This pocket electronic game has two small screens and buttons for playing the game. The chips which make the computer work are hidden behind the screens.

In some cars, the computer also speaks. It can tell the driver if the seat belts are not fastened or the petrol is running low.

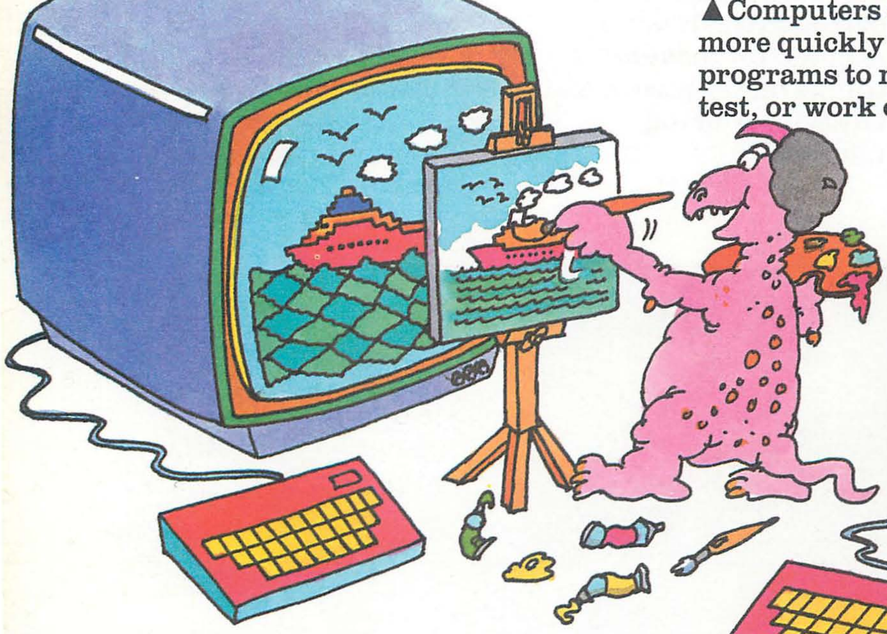

Computer screen
You can find out more about talking computers on pages 24-25.

Making a computer do things

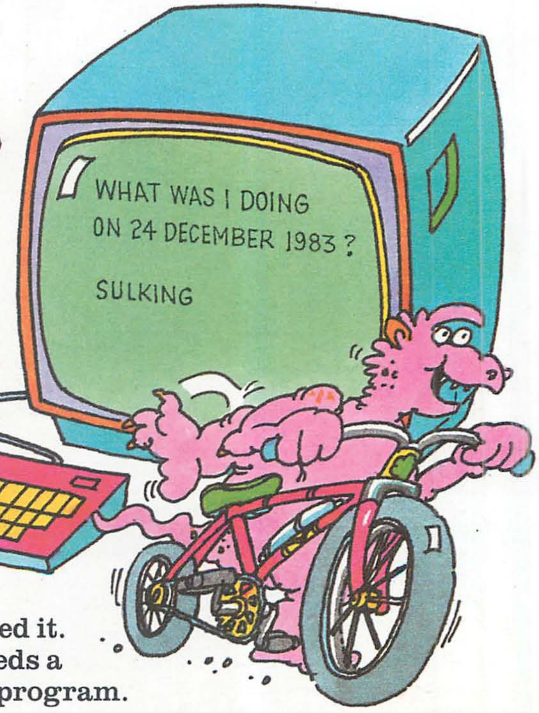
A dedicated computer, such as an electronic watch or an arcade game, can only do one thing. A home computer can do lots of different jobs. Some of these are shown in the pictures below. For each job the computer needs instructions telling it what to do.


A set of instructions for a computer is called a program.
6 x 9 = 54
9 x 54 = 486
54 x 486 = 26244

▲Computers can do calculations very fast – far more quickly than humans can. You can get programs to make a computer give you a maths test, or work out a financial forecast.



▲Programs to make a computer draw pictures on the screen are called graphics programs. You can find out more about these on pages 16-18.


WHAT WAS I DOING ON 24 DECEMBER 1983 ?
SULKING

►A computer can store information, and find it for you when you need it. To do this the computer needs a program called a database program.

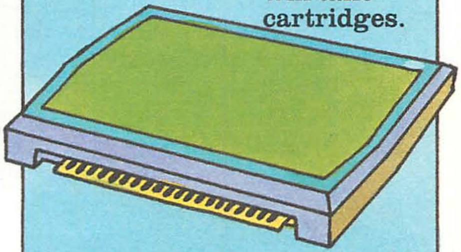
More about programs

If you know how, you can write computer programs yourself, or you can buy them from computer shops.

In the pictures below you can see three different forms in which computer programs are sold.

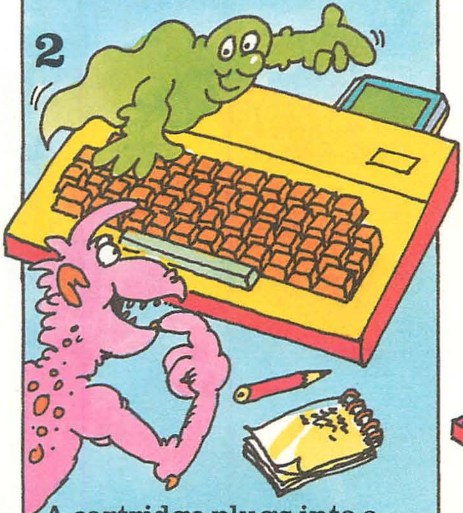
1 Cartridges

Not all home computers will take cartridges.



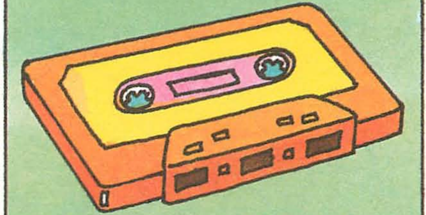
The program for the computer game on pages 4-5 is stored in a box called a cartridge.

2



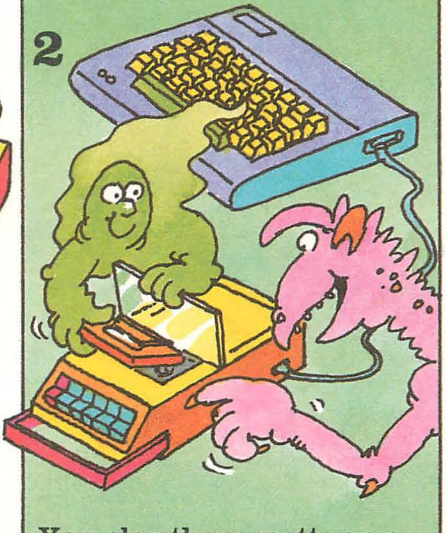
A cartridge plugs into a slot in the back or side of the computer case. Then the computer can "read" the program instructions stored in it.

1 Cassettes



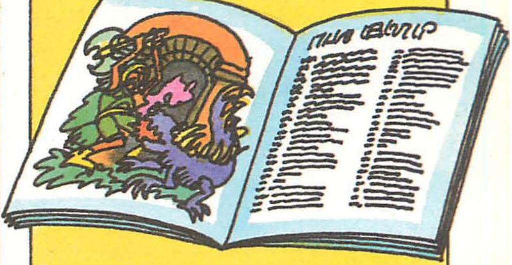
Computer programs are also stored as a code of high-pitched bleeps on a cassette tape.

2



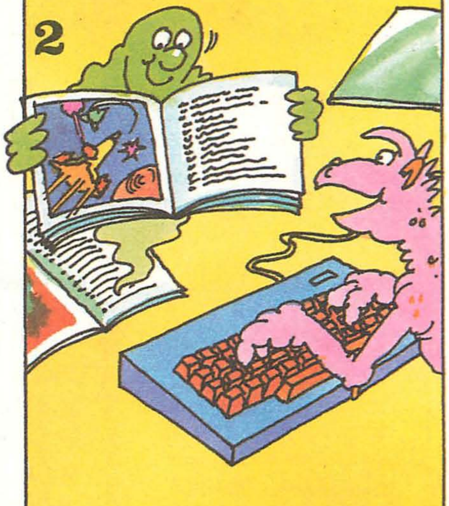
You play the cassette on a cassette recorder connected to the computer. This is called loading a program.

1 Program listings



Programs printed in words and symbols are called listings. The words and symbols are part of a special computer language.

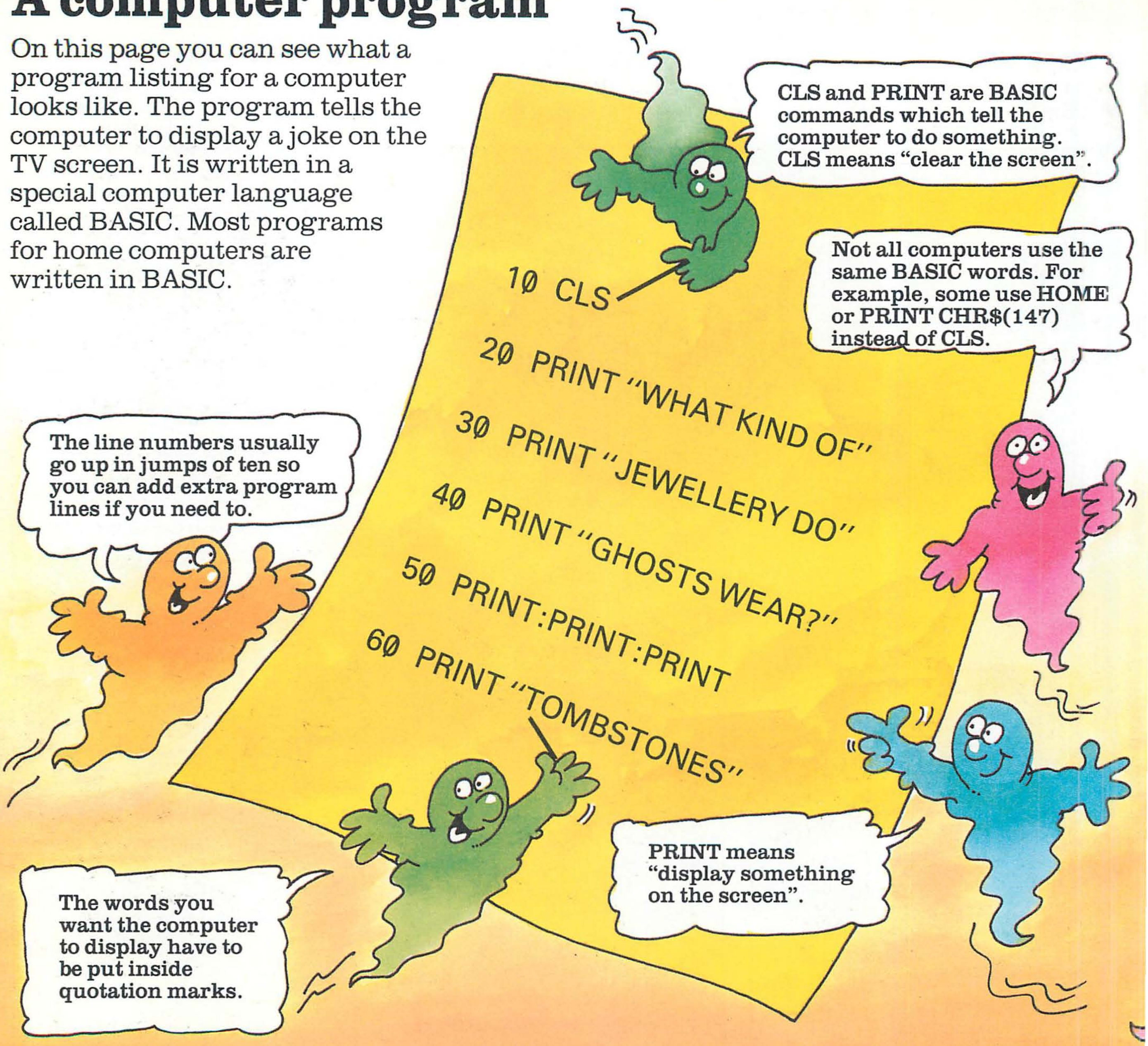
2



You have to type in listings word by word using the computer keys. Many computer books and magazines contain listings.

A computer program

On this page you can see what a program listing for a computer looks like. The program tells the computer to display a joke on the TV screen. It is written in a special computer language called BASIC. Most programs for home computers are written in BASIC.



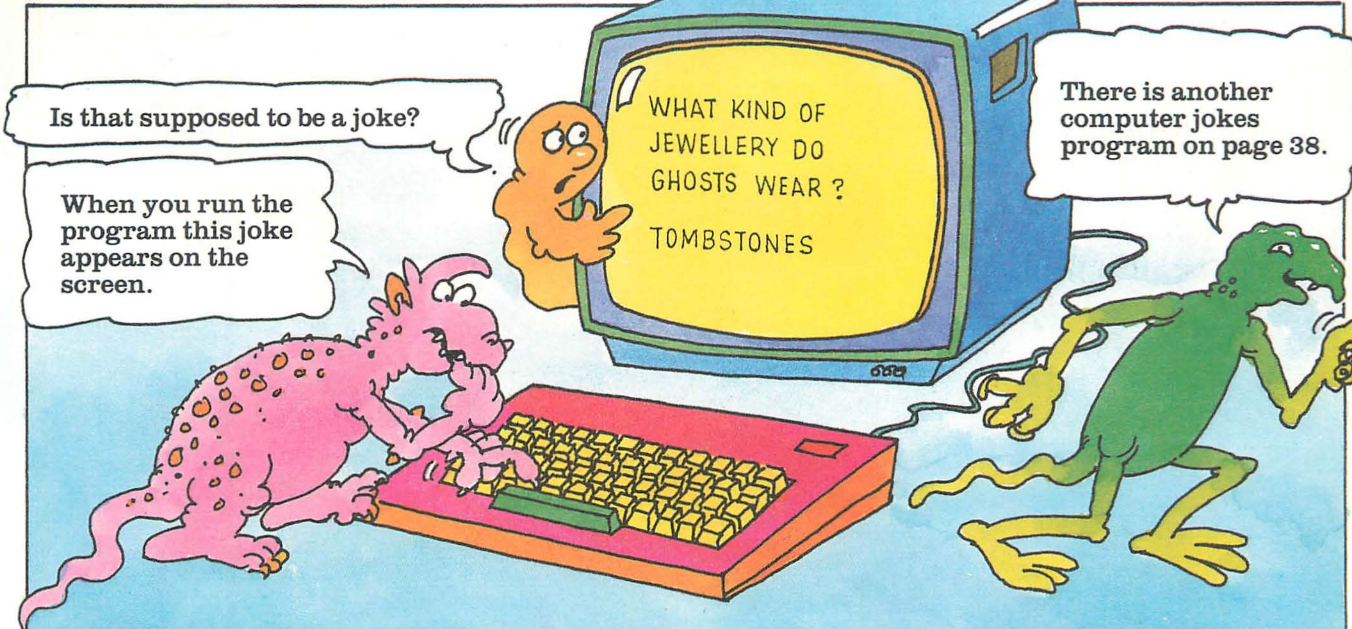
```
10 CLS
20 PRINT "WHAT KIND OF"
30 PRINT "JEWELLERY DO"
40 PRINT "GHOSTS WEAR?"
50 PRINT:PRINT:PRINT
60 PRINT "TOMBSTONES"
```

CLS and PRINT are BASIC commands which tell the computer to do something. CLS means "clear the screen".
Not all computers use the same BASIC words. For example, some use HOME or PRINT CHR$(147) instead of CLS.
The line numbers usually go up in jumps of ten so you can add extra program lines if you need to.
PRINT means "display something on the screen".
The words you want the computer to display have to be put inside quotation marks.

BASIC is like a code made up of symbols and words. Most of the words are like English words and it is quite easy to guess what they mean.

In the program each instruction is on a separate line. The lines are numbered so the computer carries out the instructions in the right order.

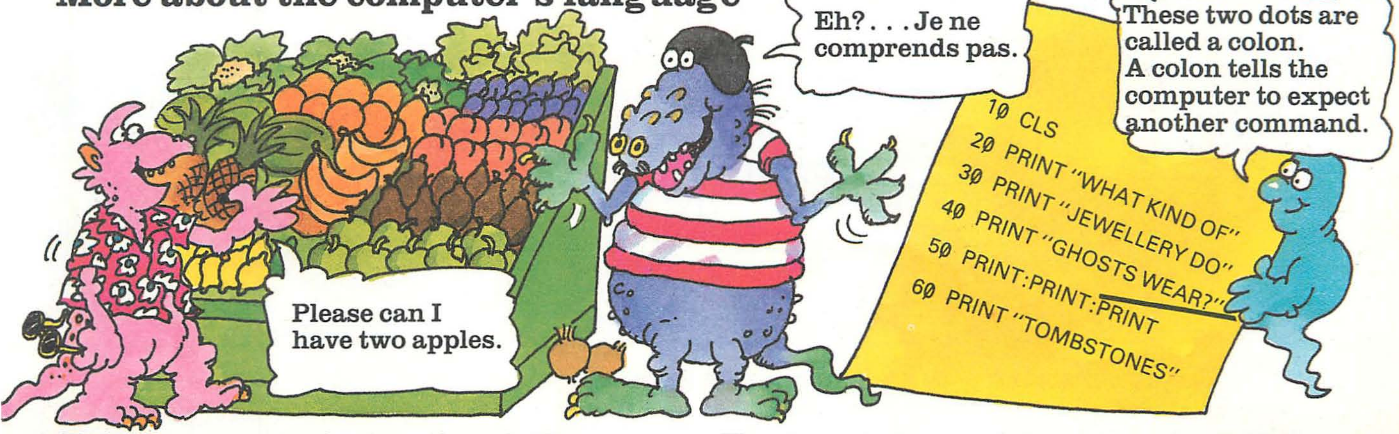
Trying the program out


Is that supposed to be a joke?
When you run the program this joke appears on the screen.
There is another computer jokes program on page 38.

```
WHAT KIND OF
JEWELLERY DO
GHOSTS WEAR?

TOMBSTONES
```

If you have a computer, try typing in the program. See page 46 to check whether you need to change any of the commands for your computer. There are hints for typing in programs on pages 32-33. To make the program work you have to type in the BASIC command RUN. This is called running the program.

More about the computer's language


Eh? . . . Je ne comprends pas.
These two dots are called a colon. A colon tells the computer to expect another command.
Please can I have two apples.

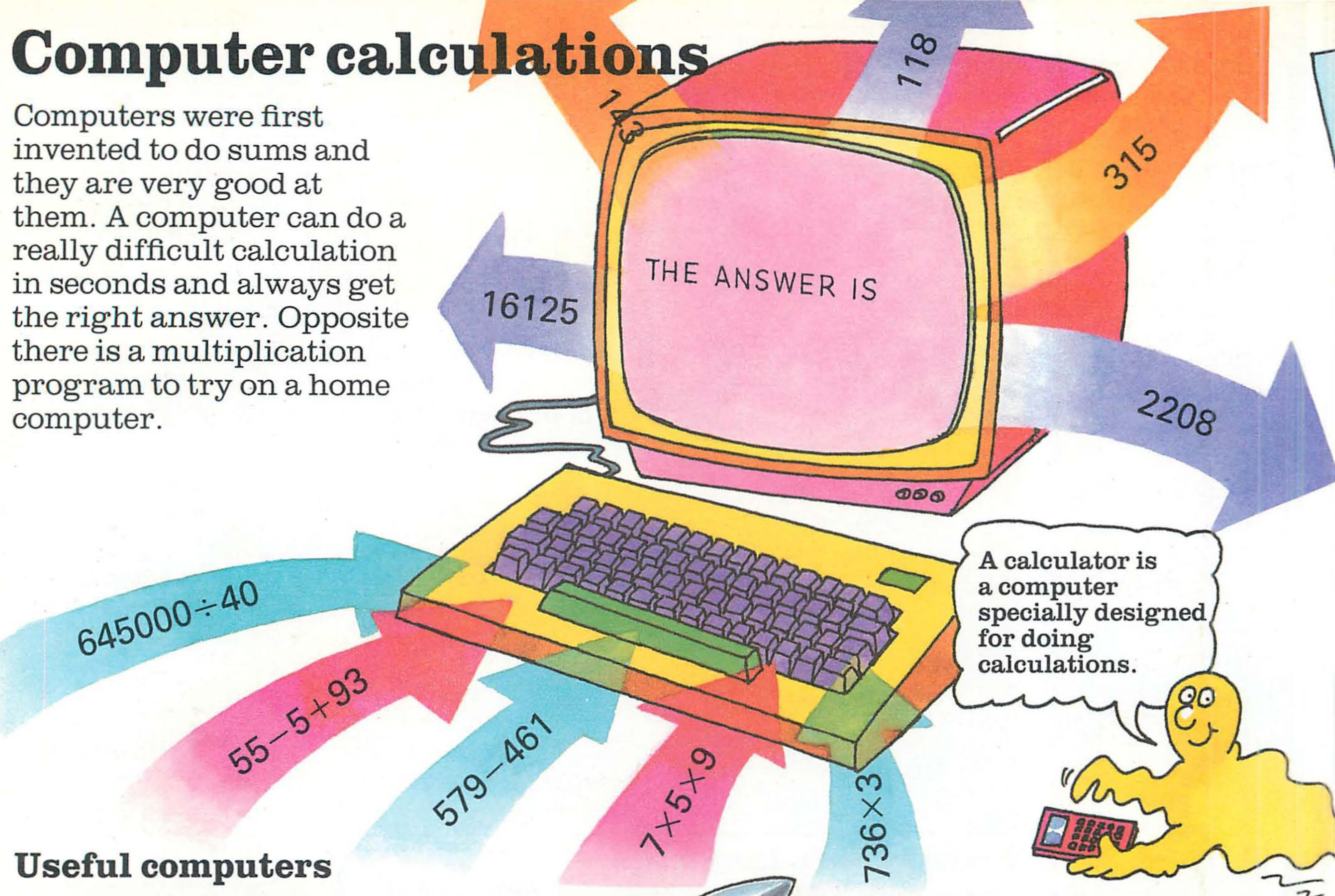
```
10 CLS
20 PRINT "WHAT KIND OF"
30 PRINT "JEWELLERY DO"
40 PRINT "GHOSTS WEAR?"
50 PRINT:PRINT:PRINT
60 PRINT "TOMBSTONES"
```

Giving a computer instructions is like talking to a French or German person. You have to speak to the computer in its own language or else it cannot understand you.

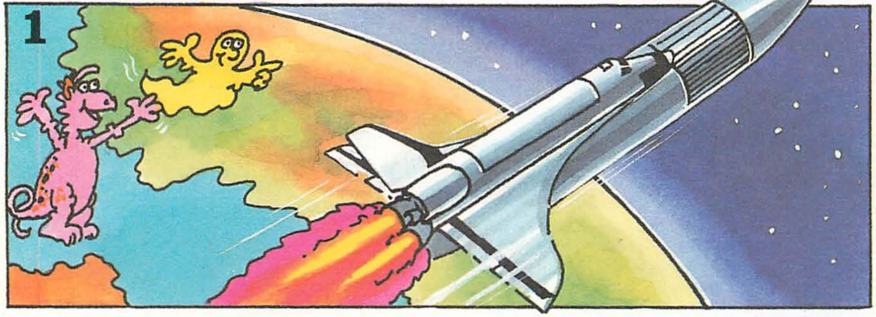
You have to be careful not to make mistakes in the language. In BASIC every dot and comma means something so take care not to miss them out when you type in programs.

Computer calculations

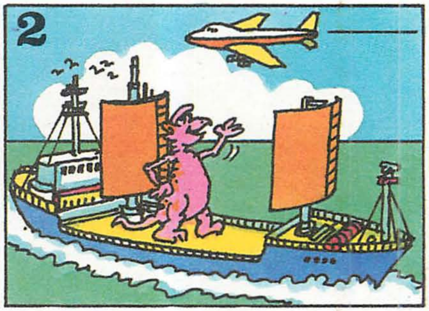
Computers were first invented to do sums and they are very good at them. A computer can do a really difficult calculation in seconds and always get the right answer. Opposite there is a multiplication program to try on a home computer.


143
118
315
16125
THE ANSWER IS
2208
645000÷40
55−5+93
579−461
7×5×9
736×3
A calculator is a computer specially designed for doing calculations.

Useful computers



Rockets and spacecraft have very powerful computers on board. These can do enormous calculations in seconds. The calculations have to be done very quickly to keep the spacecraft on the correct course, or make sure it lands safely.

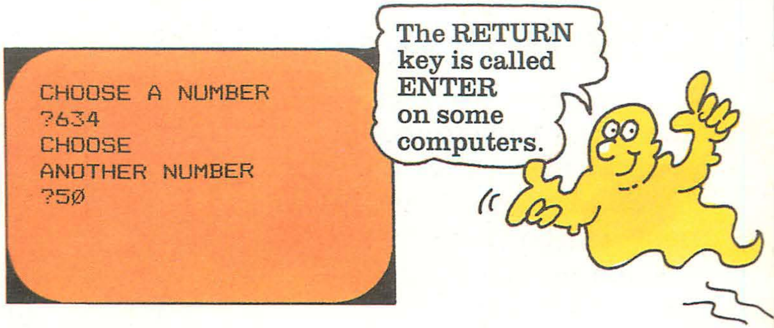


Ships and aeroplanes use computers for navigation. The computers calculate where the ship or plane is, and in what direction it should travel.

Multiplication program

```
10 PRINT "CHOOSE A NUMBER"

20 INPUT A

30 PRINT "CHOOSE"

40 PRINT "ANOTHER NUMBER"

50 INPUT B

60 PRINT A;" X ";B;" = ";A * B
```

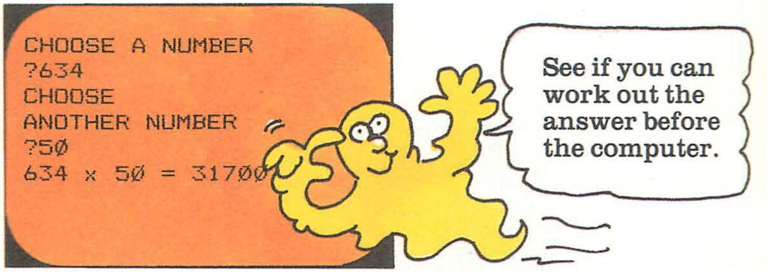
To try this program type it in exactly as it is written and run it. Make sure you type all the punctuation marks and spaces. (For hints on typing in and running programs see pages 32-33).



```
CHOOSE A NUMBER
?634
CHOOSE
ANOTHER NUMBER
?50
```

The RETURN key is called ENTER on some computers.

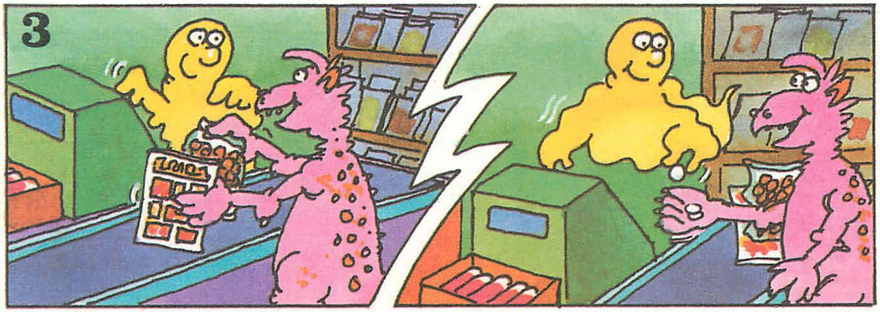
When you run the program the computer asks you to choose two numbers as shown here. Type them in, pressing the RETURN key after each one.



```
CHOOSE A NUMBER
?634
CHOOSE
ANOTHER NUMBER
?50
634 x 50 = 31700
```

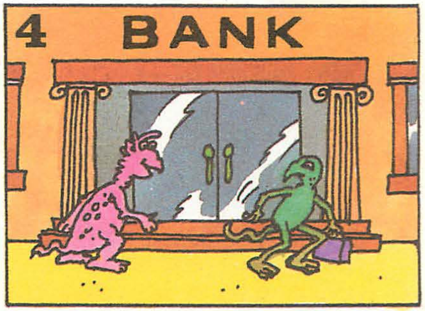
See if you can work out the answer before the computer.

In a flash the computer multiplies the numbers and displays the answer on the screen. You can run the program lots of times and make the computer multiply different numbers.



Some shop tills are computers, with a drawer to hold money. The assistant types in a code for each item you buy and the computer displays the price.

Then it adds up the total and works out how much change you need. It also keeps a record of what has been sold and how much stock is left in the shop.

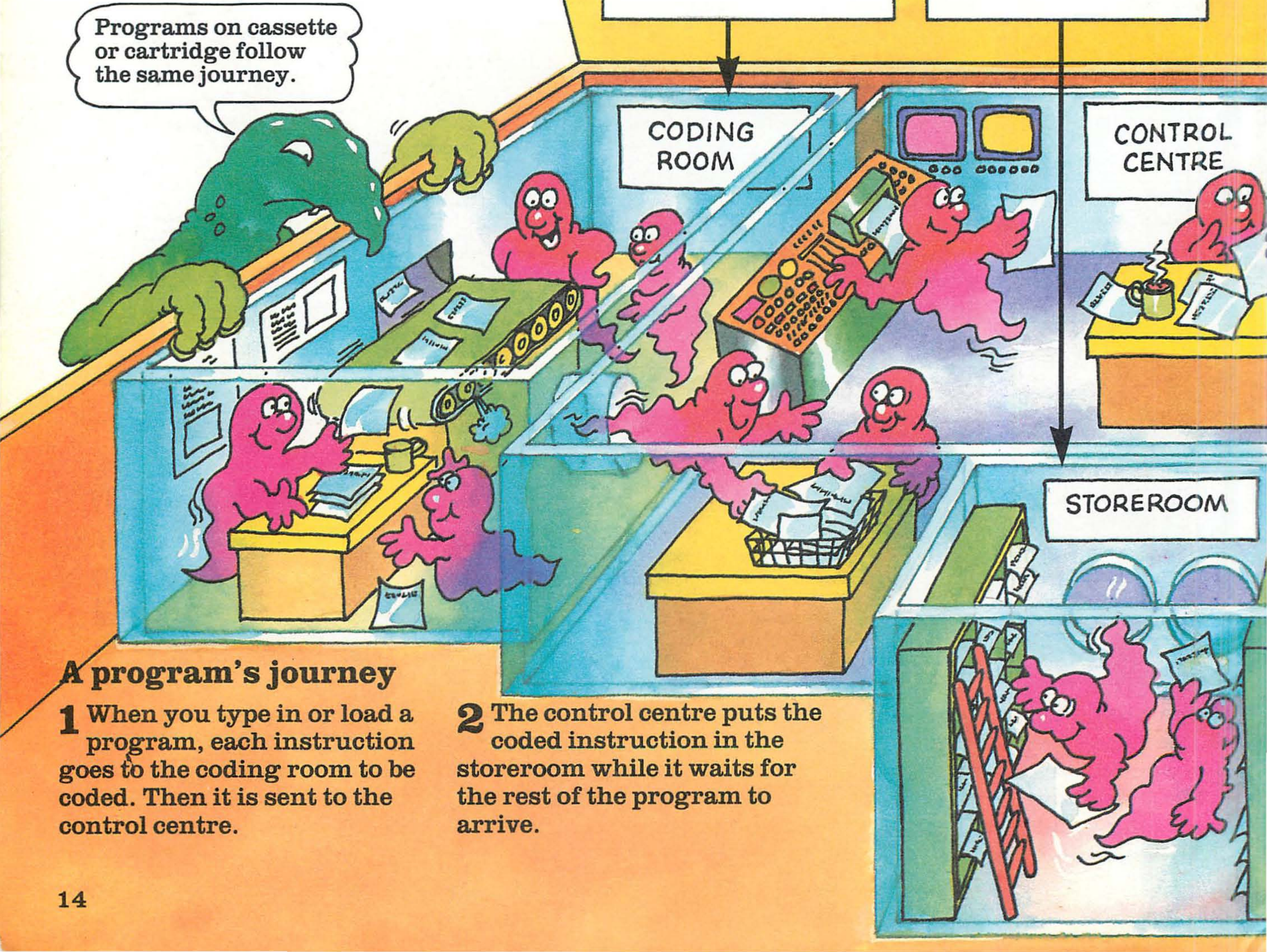


Banks use computers to keep track of money. Nowadays bank robbers do not have to blow the safe, they just need to crack the computer's password.

Inside a computer

When you type in a program, each word and symbol is changed into a code of electrical pulses. The chips inside the computer use this code to carry out the instructions.

These two pages show what happens to the program inside the computer.


Programs on cassette or cartridge follow the same journey.
CODING ROOM
CONTROL CENTRE
STOREROOM

Coding room
This is where the program instructions are changed into the code of electrical pulses.

Storeroom
The coded instructions are stored here until you tell the computer to run the program. The proper name for the storeroom is the computer's memory.

A program's journey

1 **When you type in or load a program, each instruction goes to the coding room to be coded. Then it is sent to the control centre.**

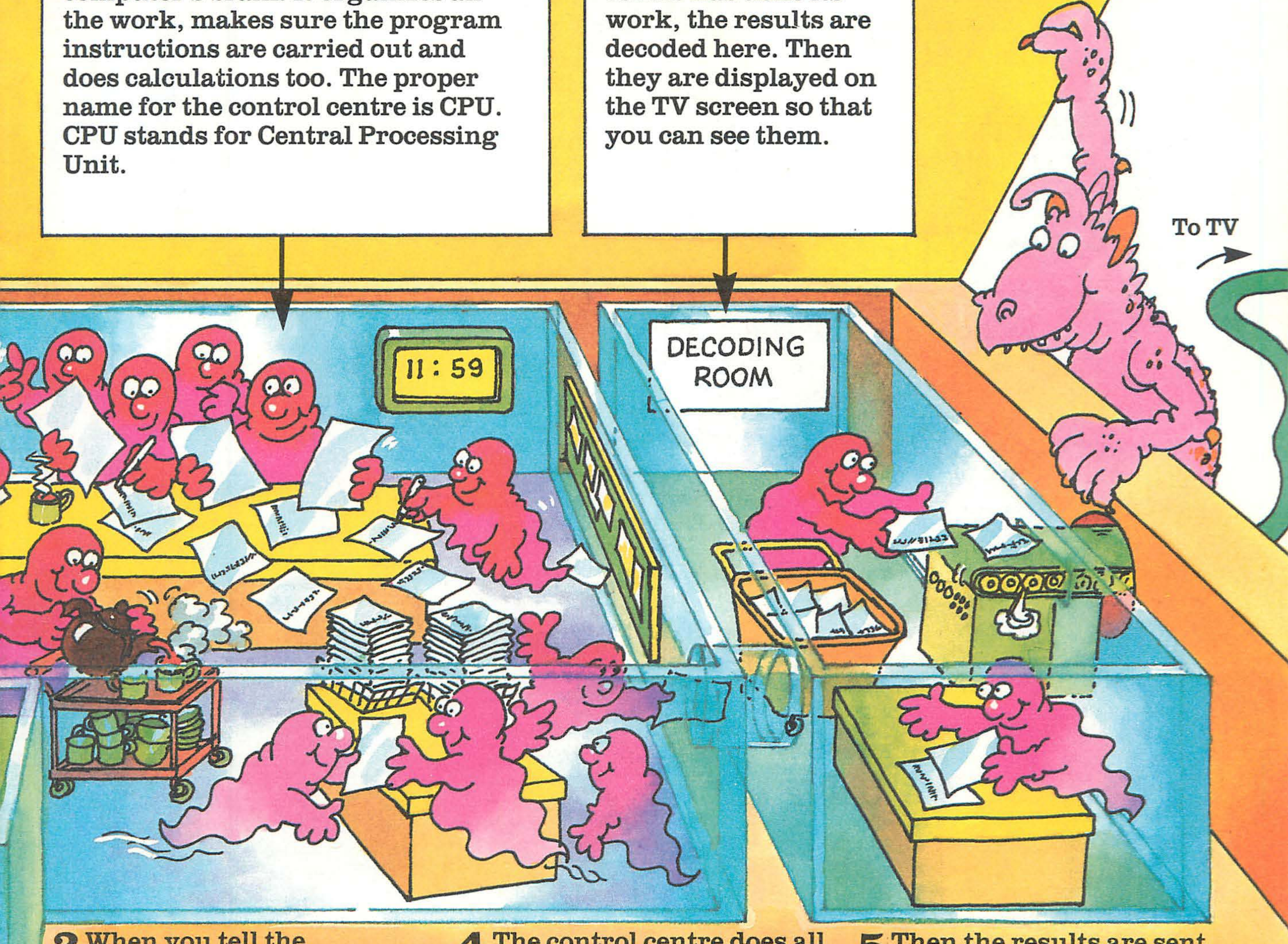
2 **The control centre puts the coded instruction in the storeroom while it waits for the rest of the program to arrive.**

Control centre

You can think of this as the computer's brain. It organizes all the work, makes sure the program instructions are carried out and does calculations too. The proper name for the control centre is CPU. CPU stands for Central Processing Unit.

Decoding room

When the control centre has done its work, the results are decoded here. Then they are displayed on the TV screen so that you can see them.



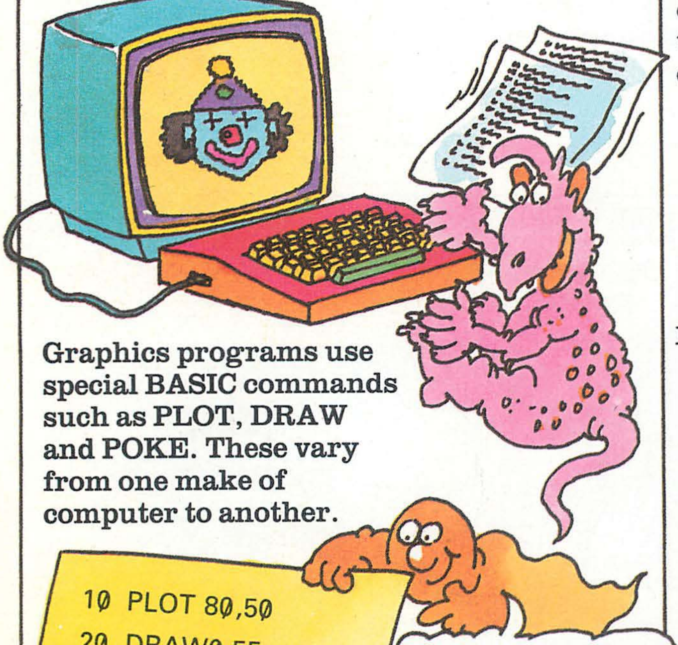
3 When you tell the computer to run the program, the control centre takes the instructions out of the storeroom and carries them out one by one.

4 The control centre does all its work in the electrical pulse code. When it has finished, the results are sent to the decoding room to be decoded.

5 Then the results are sent to the TV. The TV displays them by lighting up different parts of the screen to make words, numbers or pictures.

Making pictures

To make a computer draw a picture you have to give it a graphics program. The program tells the computer which parts of the screen to light up to make the shapes you want.



Graphics programs use special BASIC commands such as PLOT, DRAW and POKE. These vary from one make of computer to another.

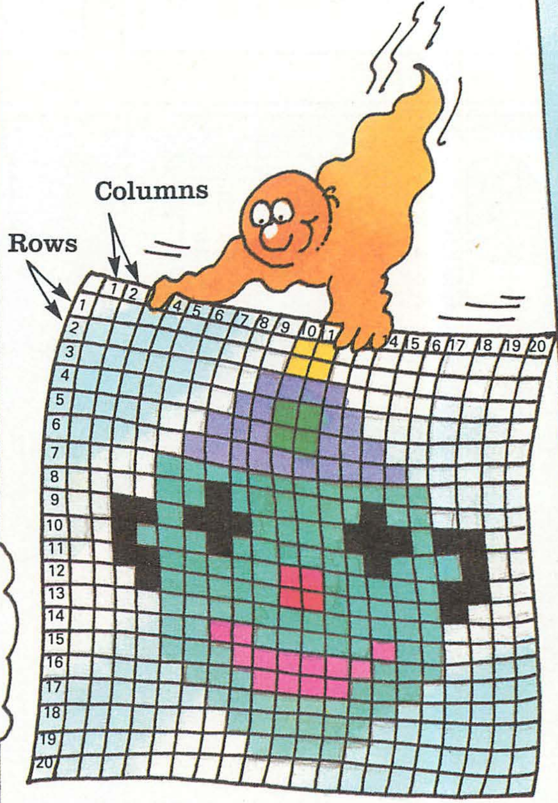
```
10 PLOT 80,50
20 DRAW0,55
30 PLOT 176,50
40 DRAW 0,55
50 PLOT 80,50
60 DRAW 96,0,PI/1,3
70 PLOT 77,105
80 DRAW 102,0
90 PAUSE 0
100 PLOT 77,105
110 DRAW INK 3;51,55
120 PLOT 170,105
```

This is part of a graphics program to draw a clown's face.

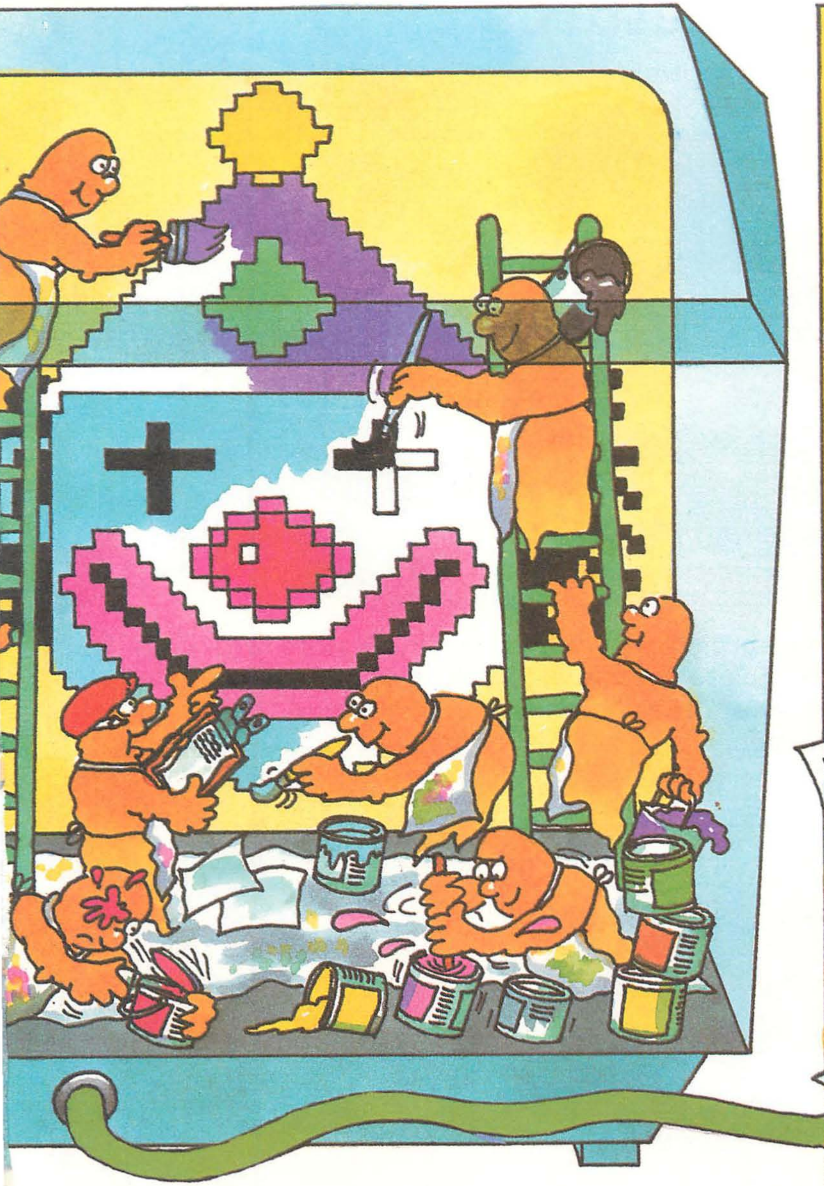
On pages 42-44 there is a short graphics program to try.

How a computer makes pictures

A computer makes pictures by lighting up tiny squares on the screen called pixels (short for picture elements). If you look closely at a computer picture you can see that the pixels make the edges of the picture jagged.



Inside its memory the computer has a map showing the rows and columns of pixels on the screen. Each column and row has a number. In a graphics program you tell the computer which pixels to light up by giving their row and column numbers.

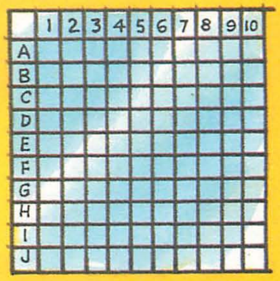


The computer sends messages to the TV, telling it to light up groups of pixels in different colours. It's like painting by numbers.

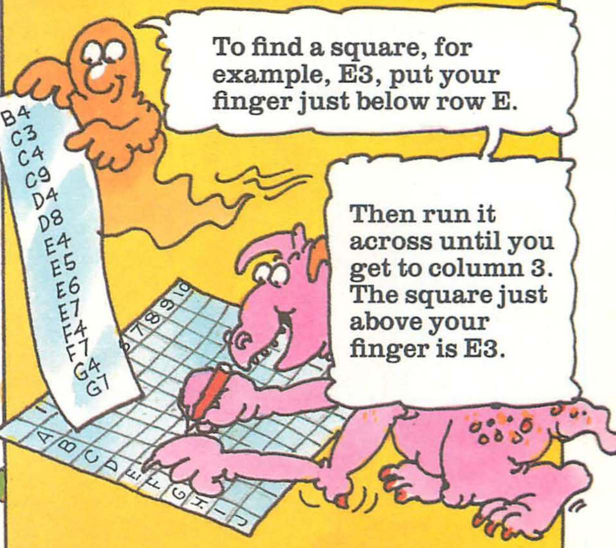
A computer also makes letter and number shapes by lighting up patterns of pixels. The number and letter shapes are called characters.

Graphics experiment

If you have some squared paper you can try making a picture in the same way as a computer does.


1 2 3 4 5 6 7 8 9 10
A
B
C
D
E
F
G
H
I
J

Imagine that the squares on the paper are pixels. Label ten squares across the paper 1 to 10 and ten squares down A to J. This makes a "screen" in which each square has a row and column number.

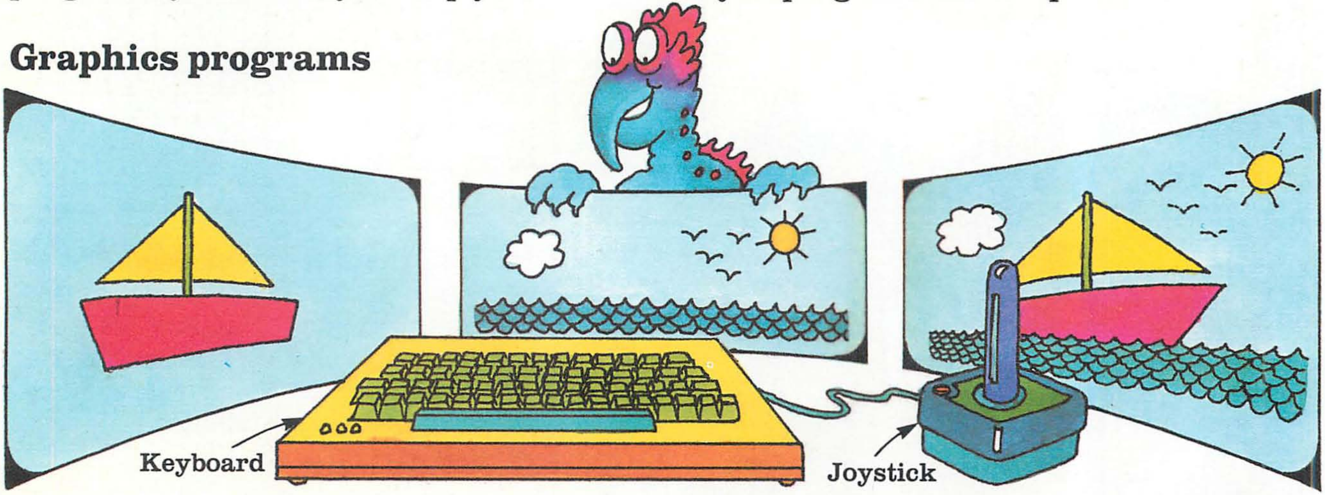

To find a square, for example, E3, put your finger just below row E.
Then run it across until you get to column 3. The square just above your finger is E3.
B4
C3
C4
C9
D4
D8
E4
E5
E6
E7
F4
F7
G4
G7

Now colour in the squares shown in the ghost's list. What is the picture? Can you work out which squares you would need to colour to make a letter H?

More ways to make pictures

On this page you can find out about programs you can buy to help you do graphics and about special drawing equipment which you plug into the computer.

Graphics programs

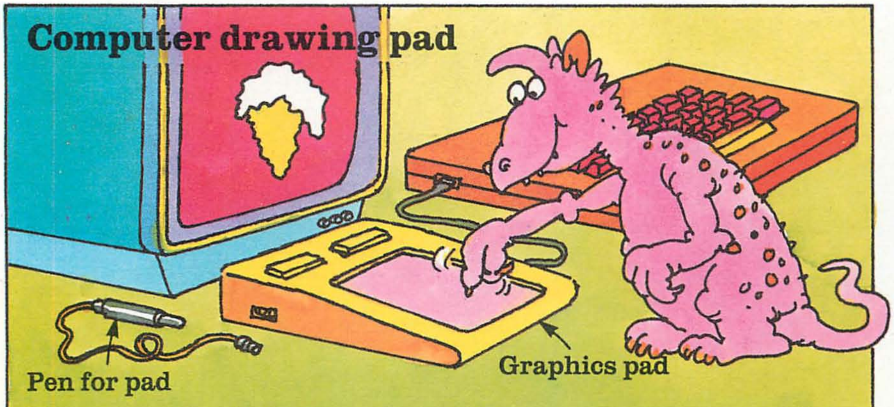


Graphics programs enable you to draw lines and coloured shapes on the screen just by pressing certain keys.

With some programs you can use a joystick to draw lines. The computer draws lines in the direction you move the stick.

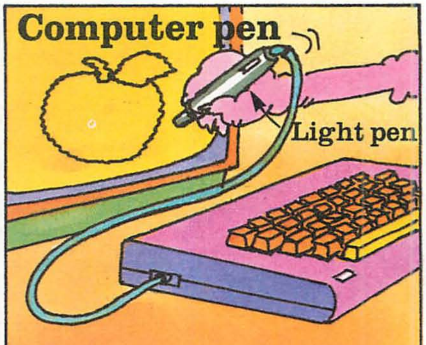
You can store the shapes you draw in the computer's memory, and then bring them all onto the screen at once to make one big picture.

Computer drawing pad



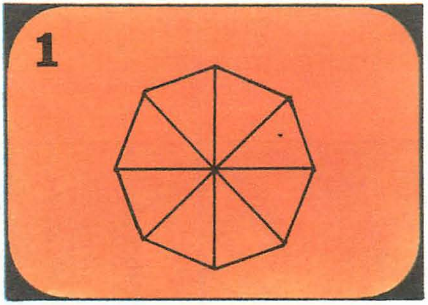
This picture shows a graphics pad. You plug it into the computer and draw on it with a special pen. The computer copies the picture onto the TV screen. You can draw on some pads with your finger, so you can do computer finger-painting.

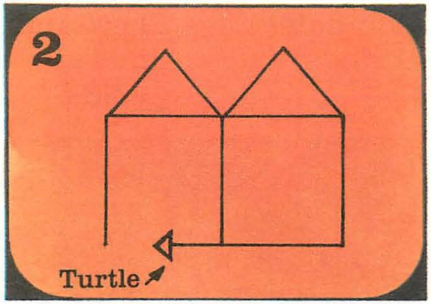
Computer pen

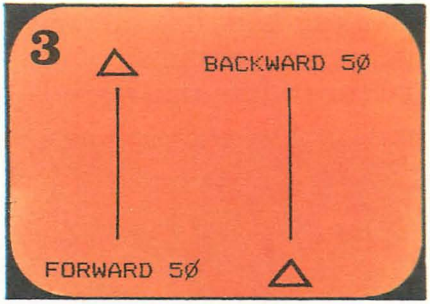


Another way to make pictures is to draw straight onto the screen using a light pen. When you move the pen across the screen, the pixels it crosses light up.

Turtle graphics

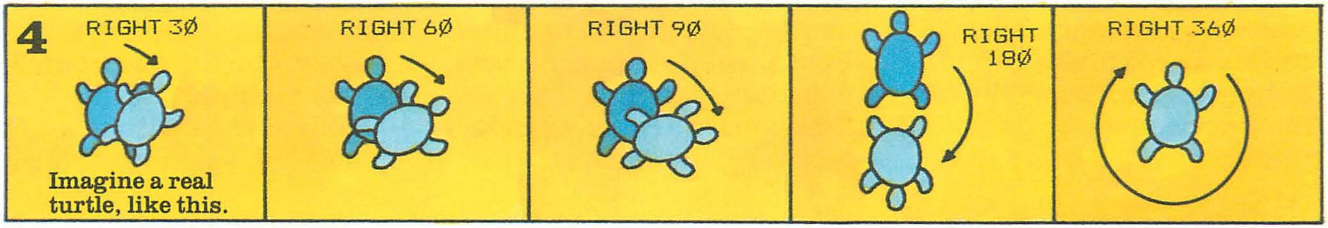





3
BACKWARD 50
FORWARD 50

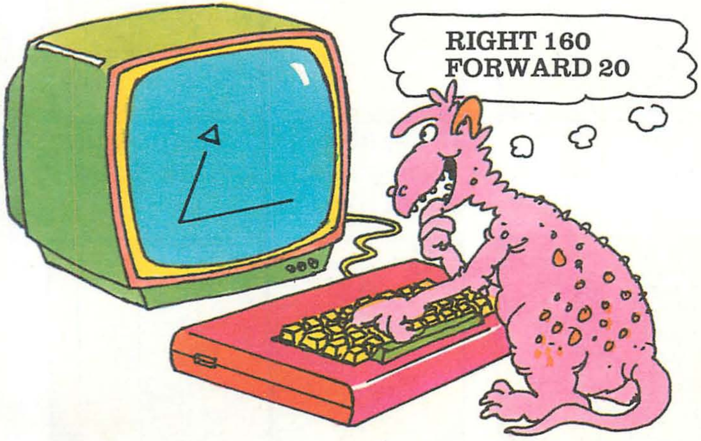
Pictures like these are made using a computer language called LOGO. In LOGO the computer displays a pointer called a turtle, on the screen. You can make the turtle move and draw lines using simple LOGO commands.

To tell the turtle to move forward or back you use the commands FORWARD and BACKWARD with a number telling the turtle how far to go.


4
RIGHT 30
Imagine a real turtle, like this.
RIGHT 60
RIGHT 90
RIGHT 180
RIGHT 360

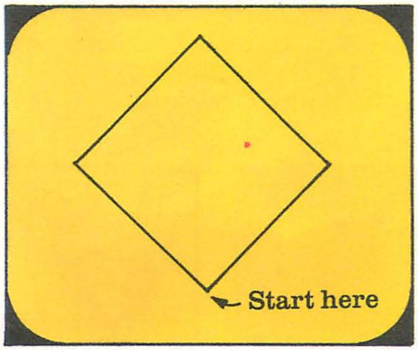
To make the turtle change direction you use the commands LEFT or RIGHT with a number for how far to turn. The amount the turtle turns is called an angle.

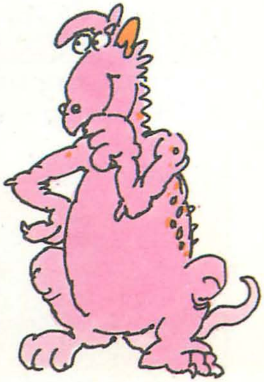
After making the turtle turn you can tell it to move forward in a new direction.


RIGHT 160
FORWARD 20

To make pictures you give the turtle a list of commands telling it to move forward, then turn, then move forward again.

Turtle puzzle

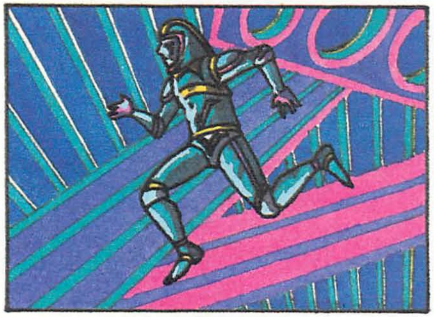




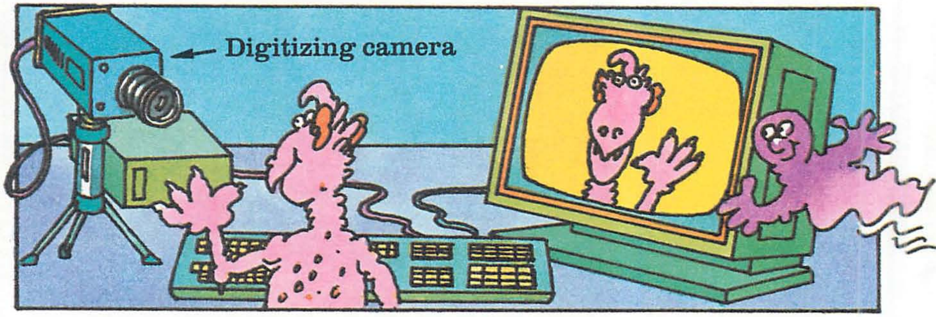
The first command to draw this picture is FORWARD 50. Can you work out what the rest are? You can check your answer on page 45.

Special effects

You can have lots of fun with computer graphics, telling a computer to distort a picture or change the colours. These and other techniques are used in films to create strange and wonderful worlds.

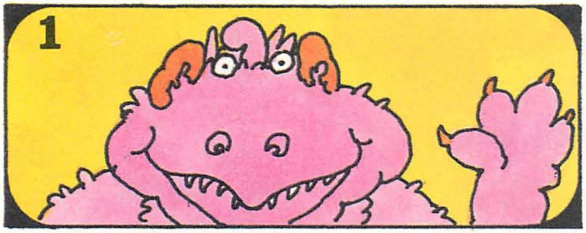


In films like TRON, real, live actors appear in a make-believe world. This is done by combining ordinary film of the actors with a background scene made by a computer.

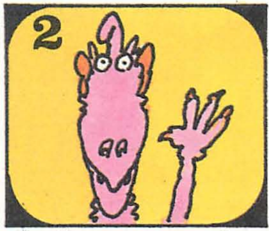


Strange effects can be made by filming a person or object with a computerized camera, called a digitizing camera. The camera divides what it sees into tiny squares. It records the colour of each square in the computer's memory. Once the computer has the picture it can do amazing things with it, as shown in the pictures below.

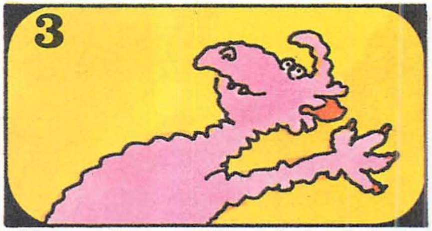
Distorting pictures



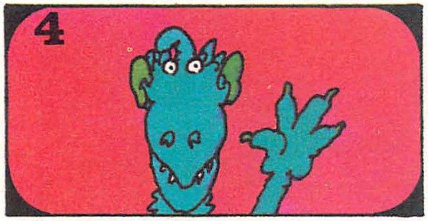
By changing the pixels a computer can stretch the picture to make it look fat.



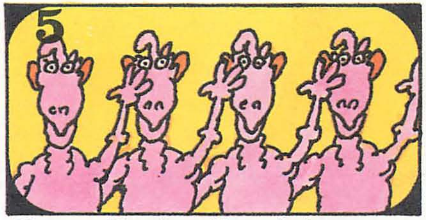
Or it can squash it up and make it look thin.



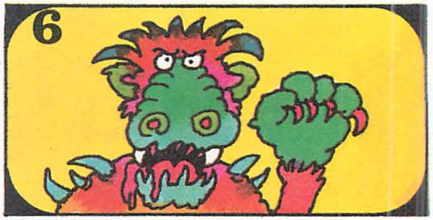
It can change the picture into a wavy shape, or make it lie down like this.



The computer can change all the colours in a picture or make it transparent.

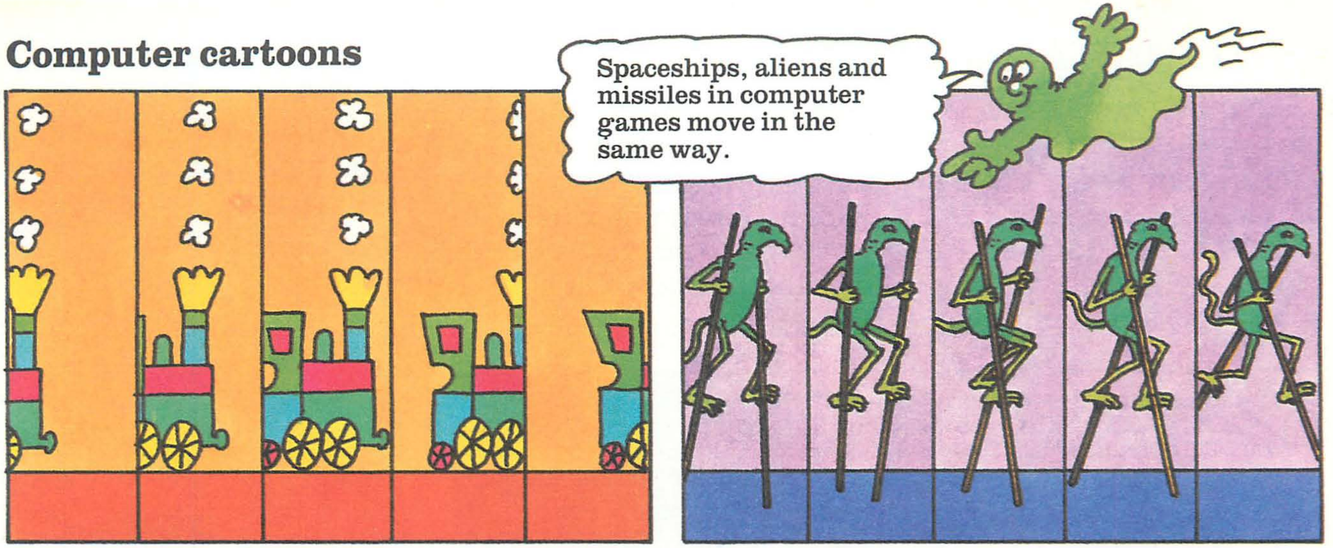


It can display the picture over and over again on the screen.



It can even transform the shape into another one with funny or horrifying effects.

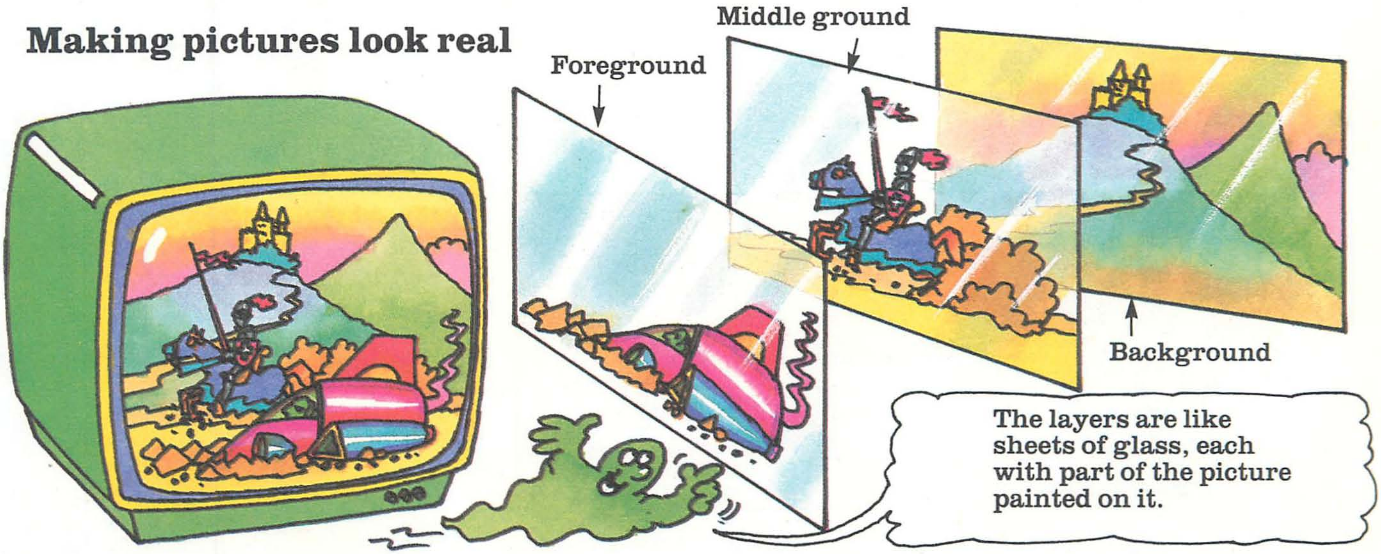
Computer cartoons


Spaceships, aliens and missiles in computer games move in the same way.

A computer can make a picture, such as this train, move across the screen. It does this by switching the pixels for the train shape on, and then off and on again in a new position.

If the computer changes the picture a little each time, as shown in this picture, it can make a more life-like cartoon. This is called computer animation.

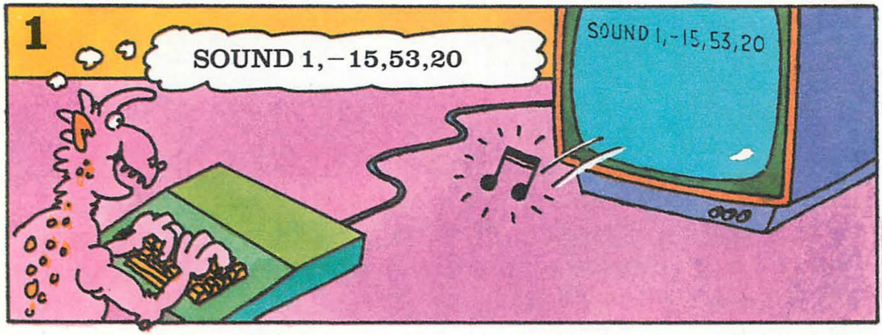
Making pictures look real


Middle ground
Foreground
Background
The layers are like sheets of glass, each with part of the picture painted on it.

To make a more realistic picture, like this one, the computer must give it depth. It does this by dividing the picture into three layers which it displays one on top of the other. In this picture the mountains and castle are on the background layer so they appear far away in the distance. The knight is on the layer for the middle ground and the spaceship is on the foreground layer.

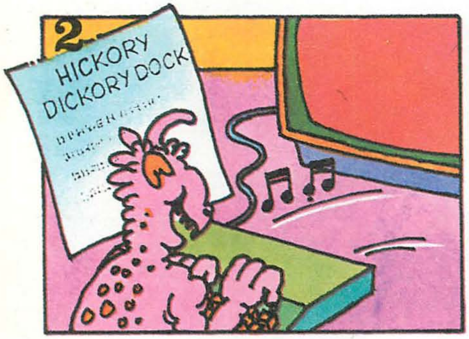
Sounds and music

A computer can be used to compose music or make exciting sound effects. The whizzes and bangs in arcade and computer games are made by the computer, following instructions in the games program. On these two pages you can see how computers make sounds. Over the page you can find out about talking computers.

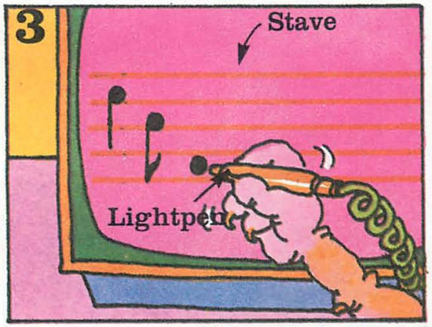


To make a home computer produce a sound you have to give it a BASIC command such as BEEP or SOUND.

This is followed by numbers which tell the computer what note to play and how loud and long it should be.



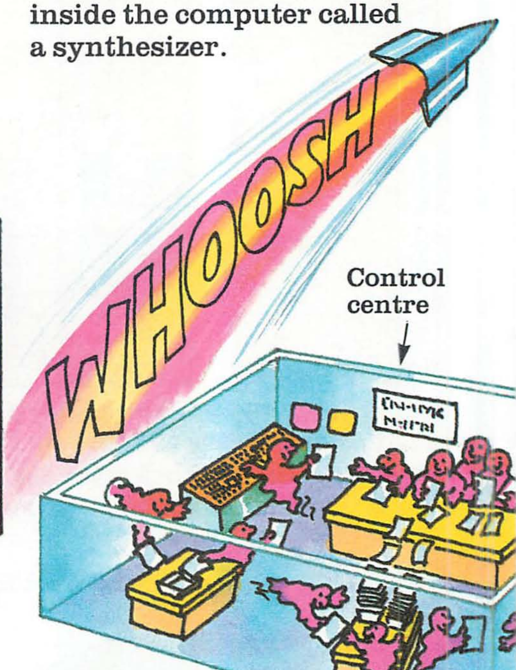
To play a tune you have to write a program of commands, one for each note. Some home computers can play several notes at once so you can make them play chords.



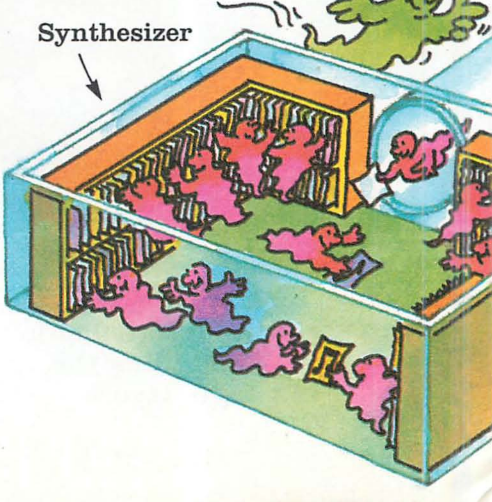
For composing music, you can buy programs which make the computer show a stave (lines for music notes) on the screen. You can use a light pen to put notes on the stave.

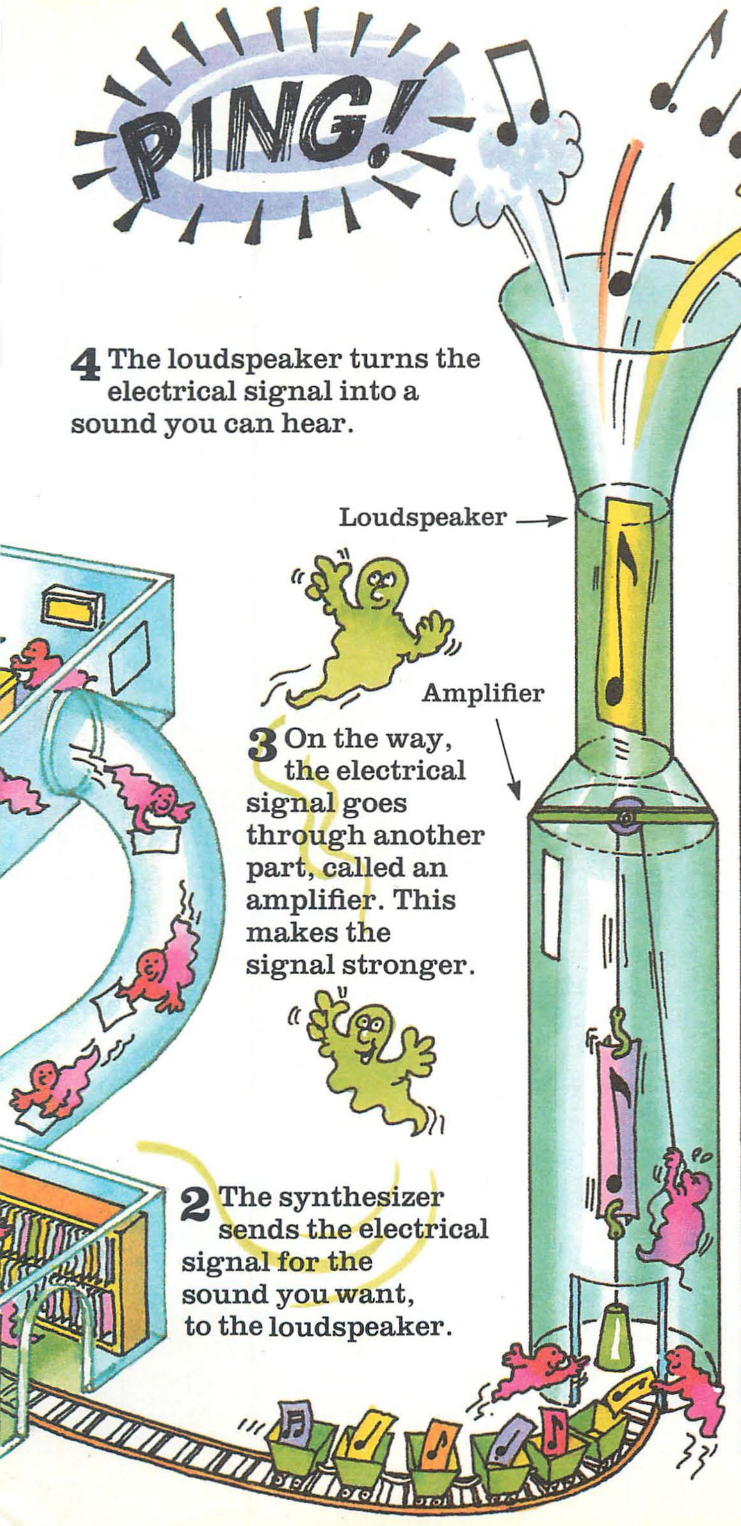
How a computer makes sounds

Sounds are made by a chip inside the computer called a synthesizer.



1 **When you give the computer a sound command the CPU (that is, the control centre) sends a message to the synthesizer.**





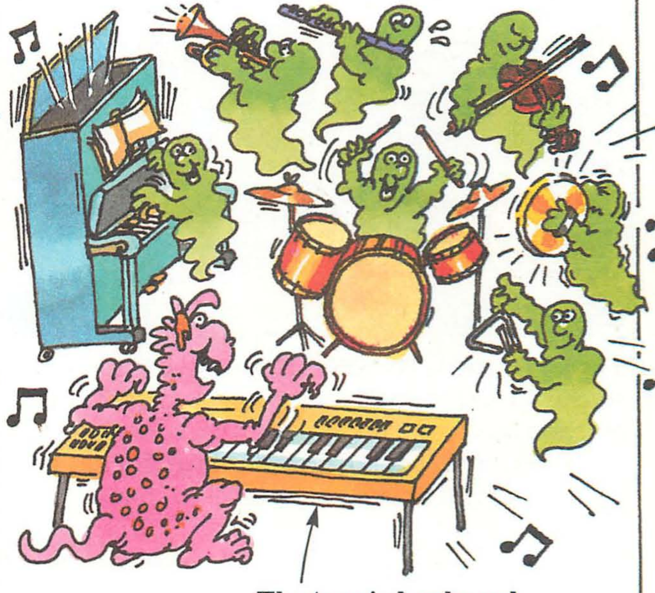
4 The loudspeaker turns the electrical signal into a sound you can hear.

3 On the way, the electrical signal goes through another part, called an amplifier. This makes the signal stronger.

2 The synthesizer sends the electrical signal for the sound you want, to the loudspeaker.

A musical computer

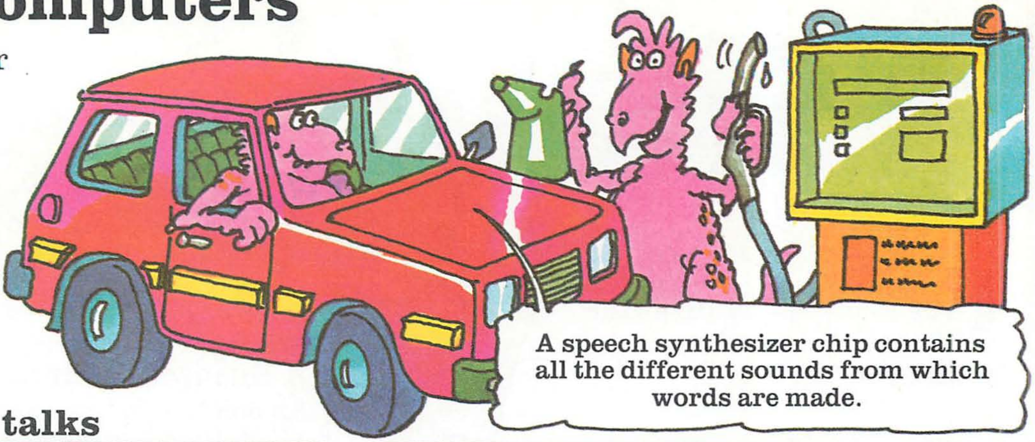
An electronic keyboard is a computer specially designed for playing music. It has keys like a piano and you can play tunes on it.



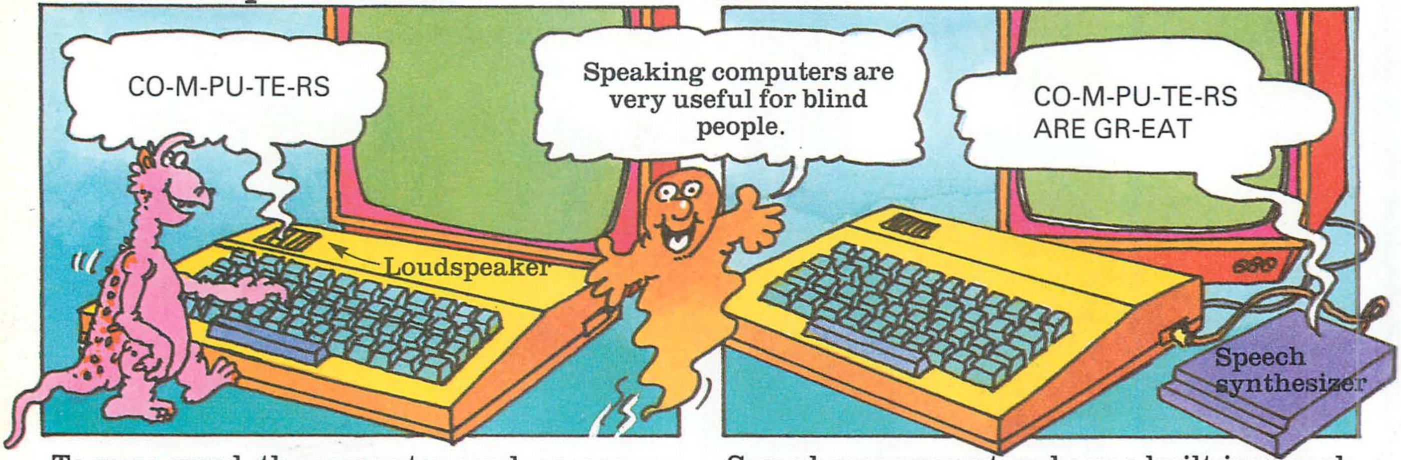
You can also program it to make the sounds of different instruments. The keyboard can store a tune in its memory and then play it back in a different rhythm. It can also play drum beats while you play on the keyboard.

Talking computers

Some computers, for instance, car computers, can speak. They have strange electronic voices though. In order to speak a computer needs a special chip called a speech synthesizer.


A speech synthesizer chip contains all the different sounds from which words are made.

How a computer talks


CO-M-PU-TE-RS
Loudspeaker
Speaking computers are very useful for blind people.
CO-M-PU-TE-RS ARE GR-EAT
Speech synthesizer

To say a word, the computer sends messages to the speech synthesizer telling it which sounds the word contains. The speech synthesizer sends the signals for these sounds to the amplifier and loudspeaker.

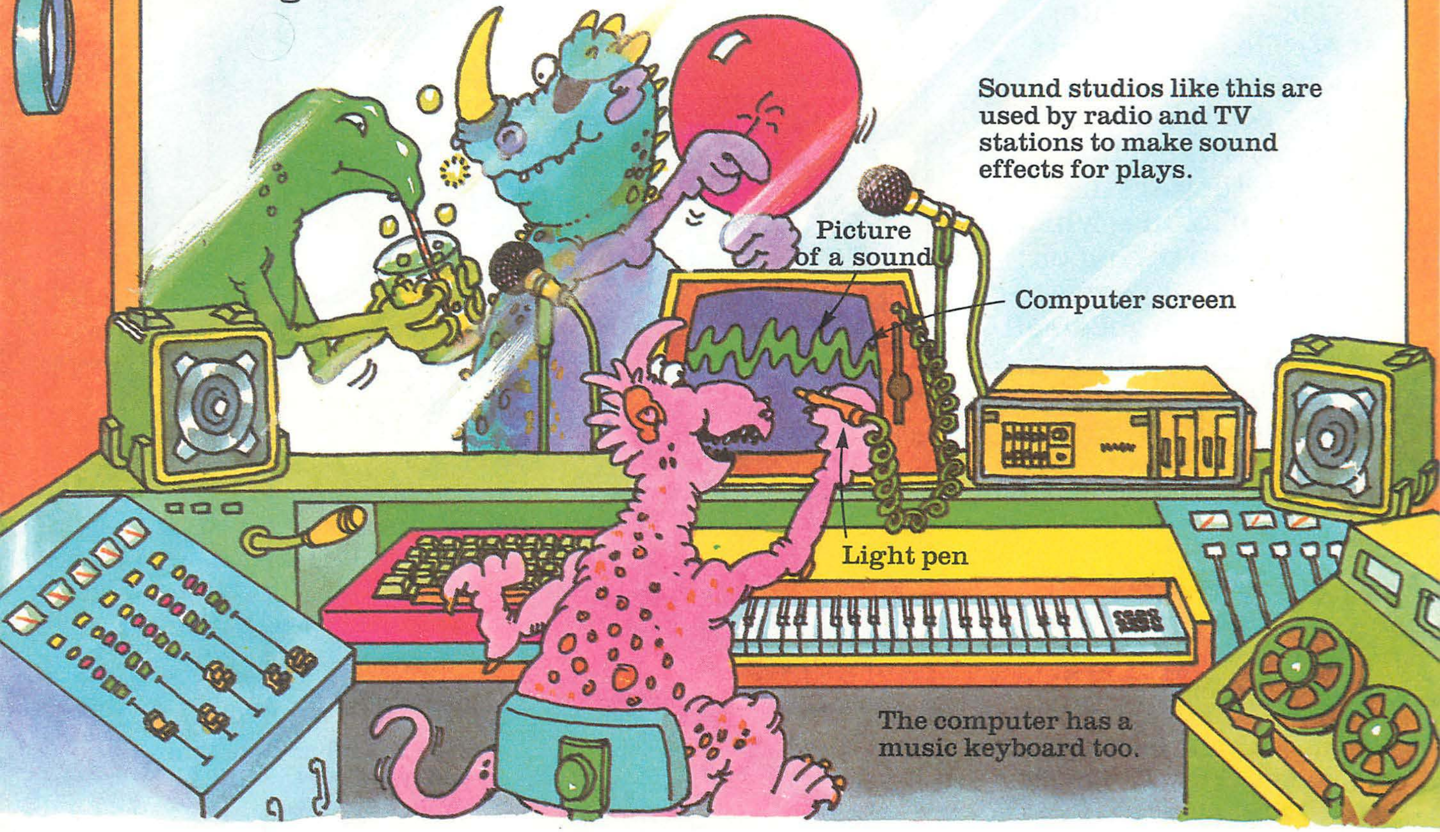
Some home computers have a built-in speech synthesizer, or you can buy one to plug in. The speech synthesizer in this picture contains 62 speech sounds. From these it can make any word in the English language.

Computer conversations

It is harder to make computers understand speech than it is to make them talk. This is because everybody says words in a slightly different way so it is difficult for the computer to recognize them.

What's the time?

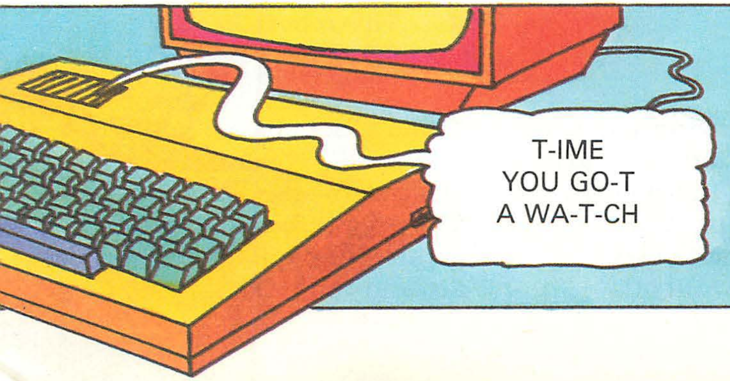
Making sound effects



Sound studios like this are used by radio and TV stations to make sound effects for plays.

The computer has a music keyboard too.

This picture shows a recording studio with a computer specially designed for making sound effects. A sound, for instance, bubbles in a drink is recorded and fed into the computer. Then the computer can make it louder, or echo and fade away. It can even play it on different notes. The computer makes a picture of the sound on the screen, and it can be altered by changing the shape of the lines, using a light pen.



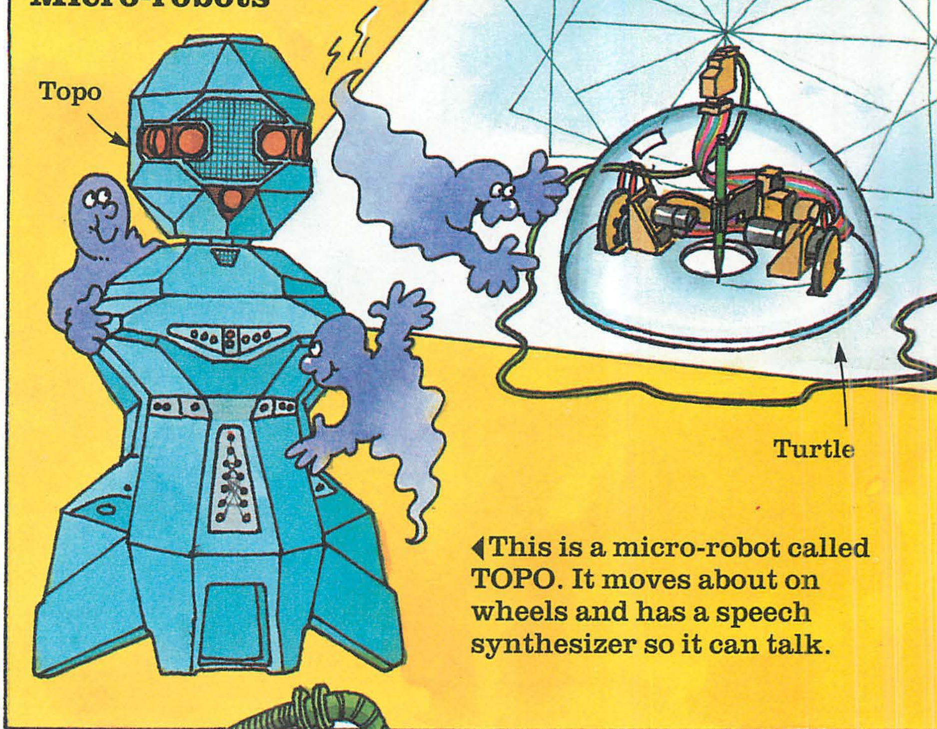
At the moment, scientists are working on computers which can be trained to recognize the voice of one particular person. Then the computer could obey simple commands such as “Stop” or “Go” or “Switch on the headlights”.

Robots

A robot is a computer-controlled machine. In science fiction films, robots act almost like humans. In real life, though, they are mainly factory machines which do jobs that are boring or dangerous for people to do.

You can also get small robots which can be controlled by a home computer. These are called micro-robots.

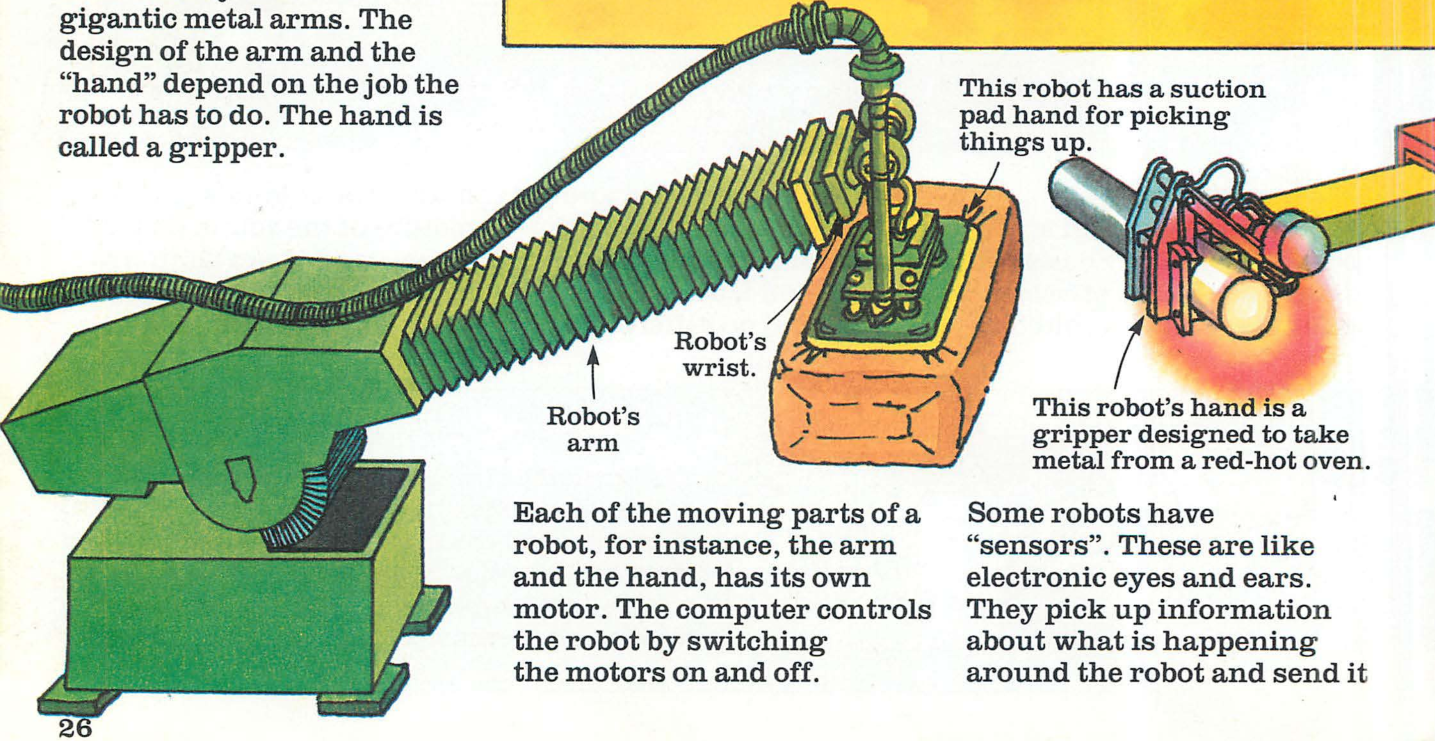
Micro-robots



◀This is a micro-robot called TOPO. It moves about on wheels and has a speech synthesizer so it can talk.

Factory robots

Most factory robots are like gigantic metal arms. The design of the arm and the "hand" depend on the job the robot has to do. The hand is called a gripper.

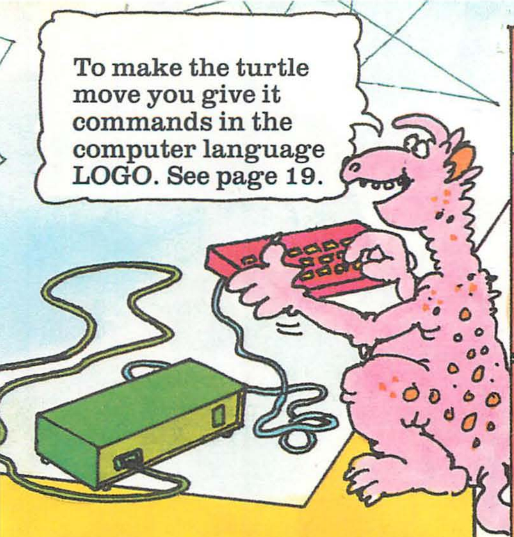


This robot has a suction pad hand for picking things up.

This robot's hand is a gripper designed to take metal from a red-hot oven.

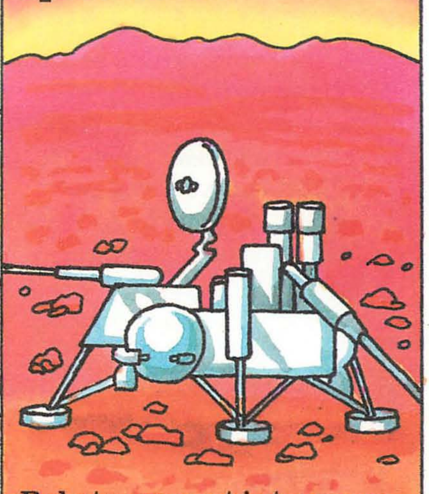
Each of the moving parts of a robot, for instance, the arm and the hand, has its own motor. The computer controls the robot by switching the motors on and off.

Some robots have "sensors". These are like electronic eyes and ears. They pick up information about what is happening around the robot and send it


To make the turtle move you give it commands in the computer language LOGO. See page 19.

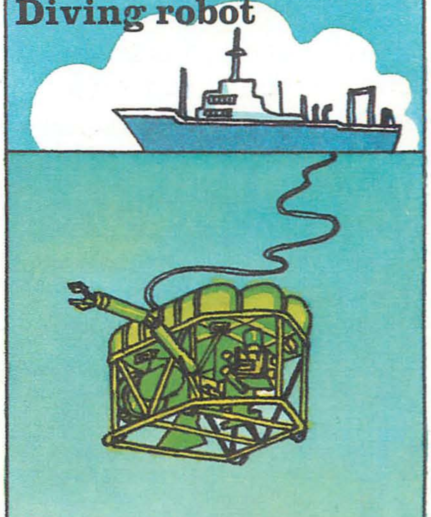
The picture above shows a micro-robot called a turtle. It has wheels and a pen underneath, and can draw a picture as it moves about.

Space robot

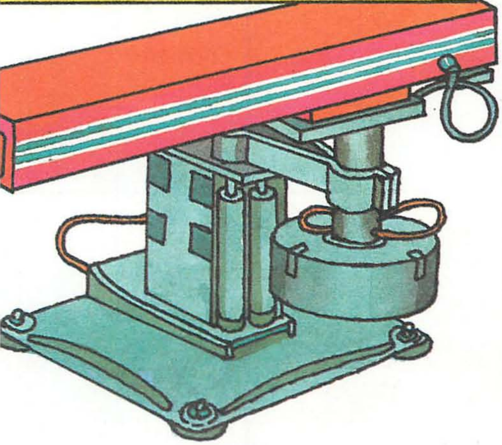


Robots are sent into space to explore planets which are too distant for humans to travel to. This picture shows a robot landing-craft carried to Mars by the spacecraft Viking 1.

Diving robot

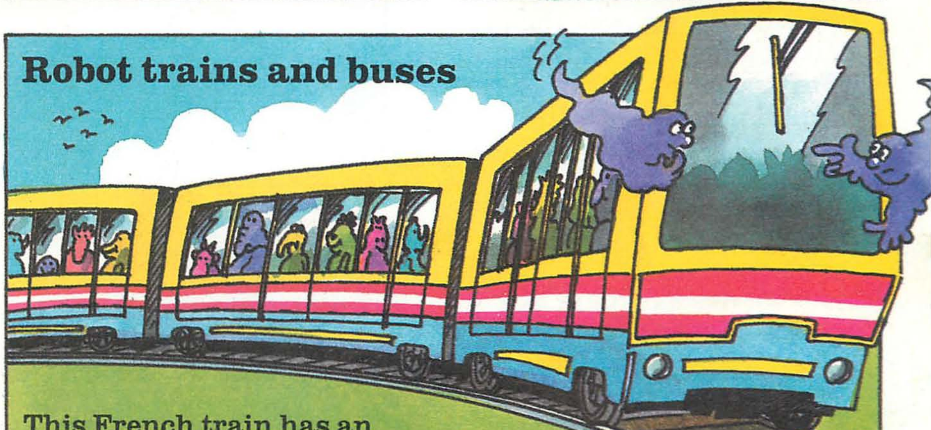


This robot moves along the seabed photographing and checking underwater pipelines to see if they are broken.



to the computer. Then, if something unexpected happens, the computer can stop the robot, or make it move, depending on the information it has received.

Robot trains and buses



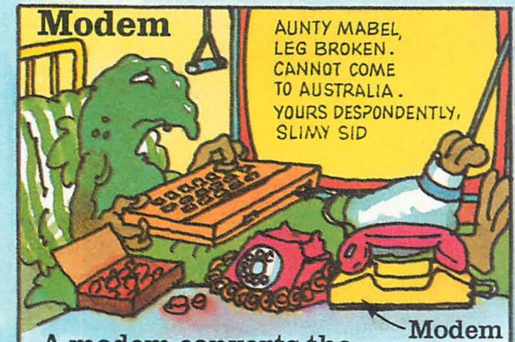
This French train has an on-board computer instead of a driver. The computer makes the train change tracks and stop automatically at stations.

You may have seen driverless buses at an airport, taking passengers from the terminal to their aeroplane.

Electronic mail

Electronic mail is a way of sending letters using a computer. The letters travel from one computer to another along telephone lines. To send electronic mail you have to pay a fee to the telephone company. You also need a piece of equipment called a modem.

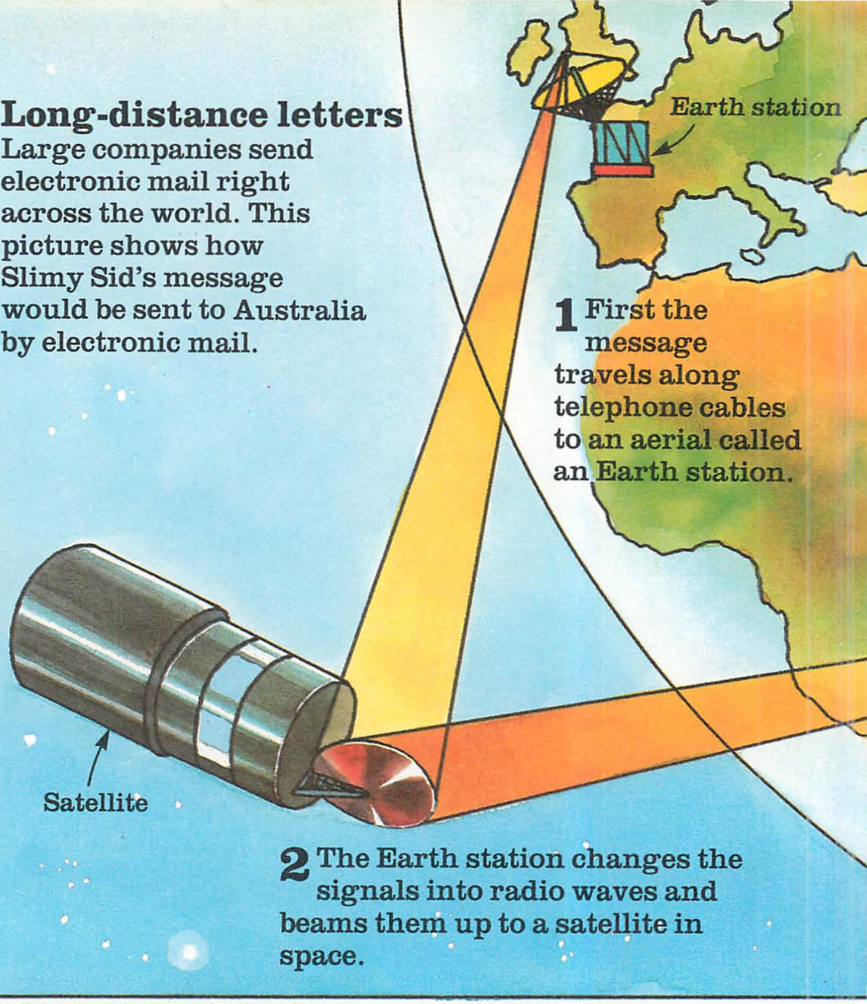
Modem


AUNTY MABEL, LEG BROKEN. CANNOT COME TO AUSTRALIA. YOURS DESPONDENTLY, SLIMY SID
Modem

A modem converts the computer's code into signals that can be sent over the phone. The modem plugs into your computer and you put the telephone receiver into it.

Long-distance letters

Large companies send electronic mail right across the world. This picture shows how Slimy Sid's message would be sent to Australia by electronic mail.



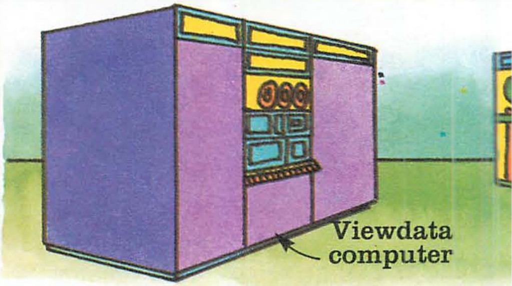
1 First the message travels along telephone cables to an aerial called an Earth station.

2 The Earth station changes the signals into radio waves and beams them up to a satellite in space.

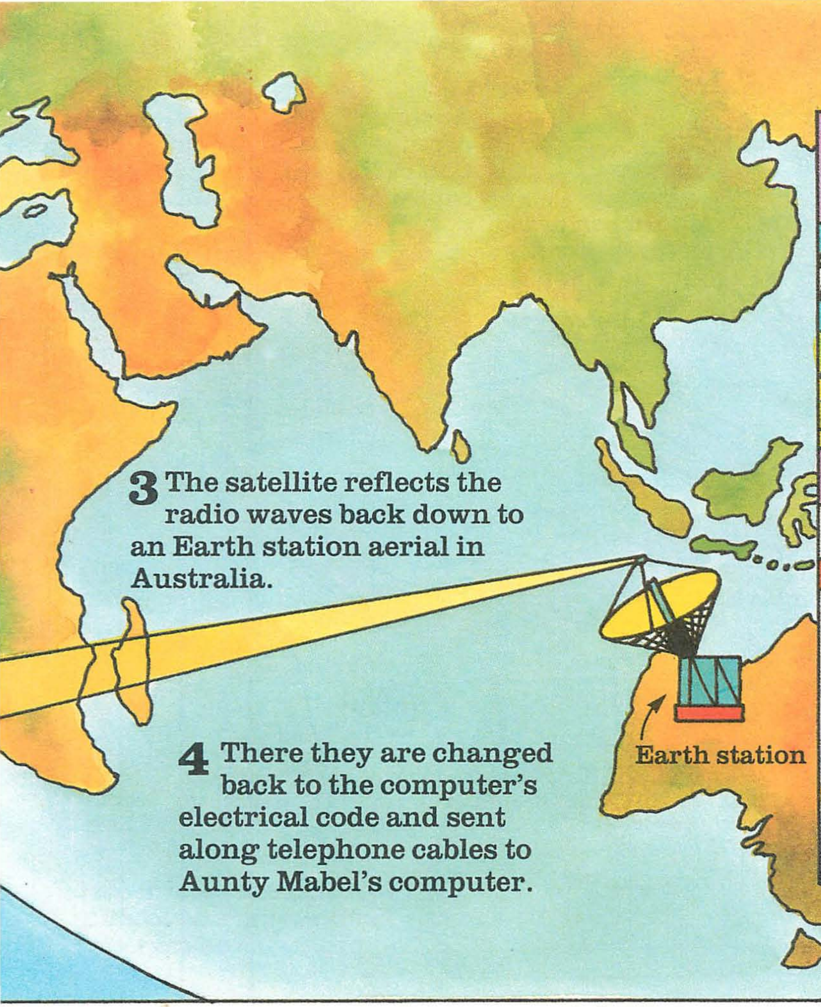
Computer information

You can use a modem to call up a computerized information centre called a viewdata system. This sends information such as train timetables, sports results or news, direct to your computer screen. Viewdata systems are usually run by telephone companies.

You pay a fee and are given a password which you use when you call up the information centre.

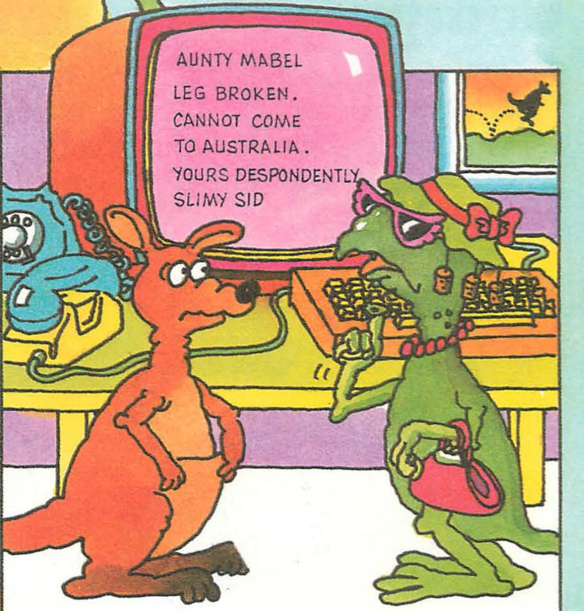


The information centre is a powerful computer. It has a huge memory called a databank.

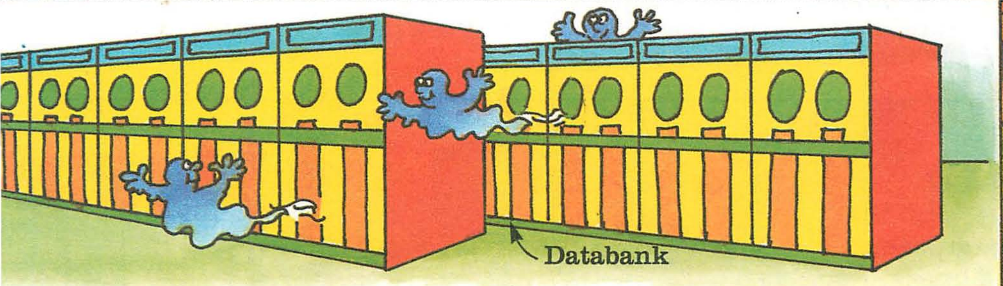

Earth station

3 The satellite reflects the radio waves back down to an Earth station aerial in Australia.

4 There they are changed back to the computer's electrical code and sent along telephone cables to Aunty Mabel's computer.


AUNTY MABEL
LEG BROKEN.
CANNOT COME
TO AUSTRALIA.
YOURS DESPONDENTLY
SLIMY SID

Lots of things besides messages are sent by electronic mail, for instance, computer pictures and sounds. Computer programs sent by electronic mail are called telesoftware.



The computer can search through the databank and find any information you ask it in seconds.

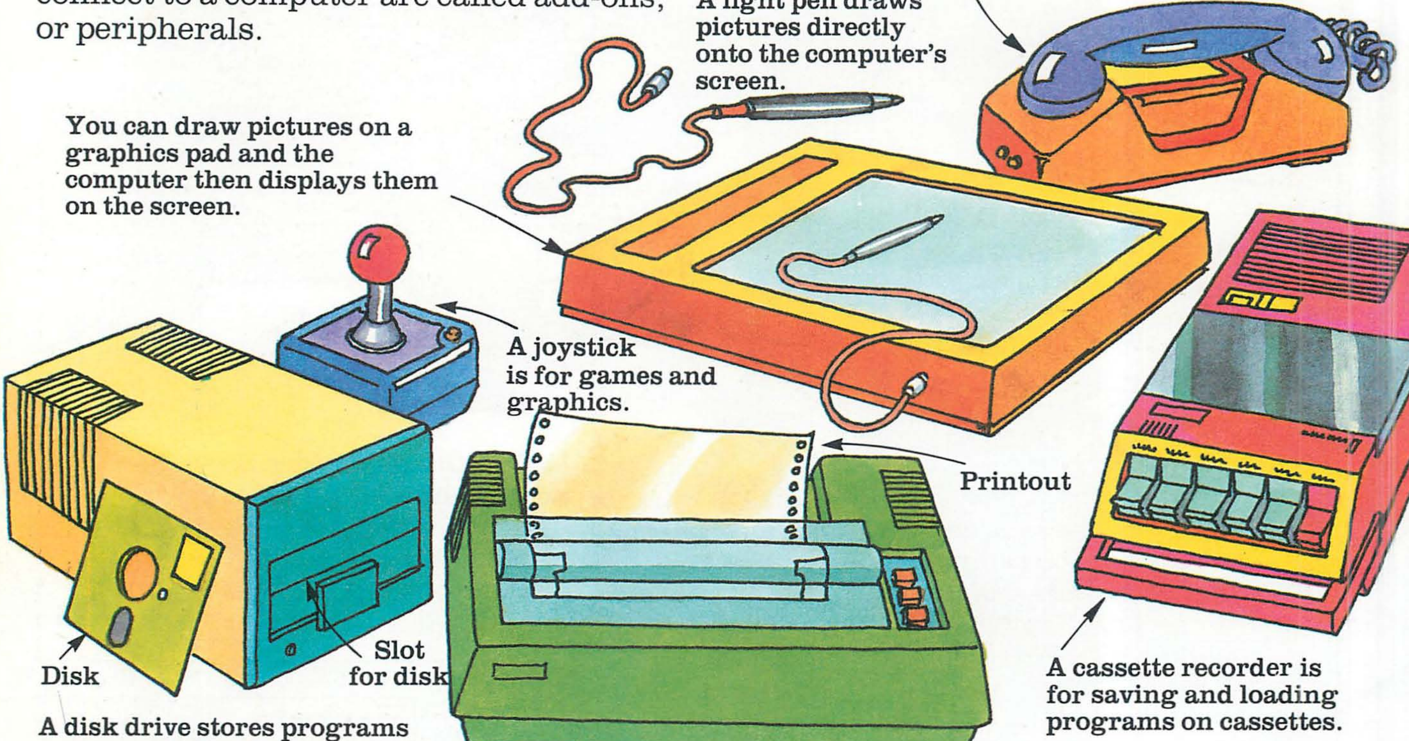
Many banks and large companies have private databanks for which only employees know the password.

Hackers

Hackers are people who use home computers to crack the password for a company's databank.

Computer equipment

These two pages show some of the extra equipment and programs you can buy for a home computer. Things you connect to a computer are called add-ons, or peripherals.



A modem is for converting computer codes into signals that can be sent along telephone cables.

A light pen draws pictures directly onto the computer's screen.

You can draw pictures on a graphics pad and the computer then displays them on the screen.

A joystick is for games and graphics.

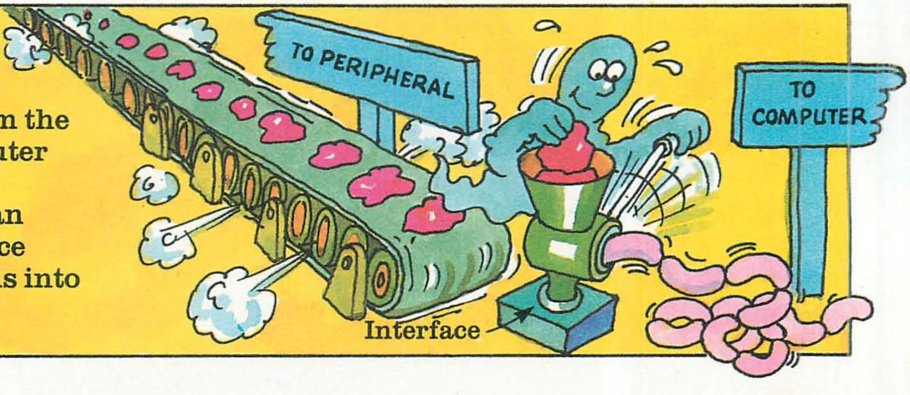
A disk drive stores programs on floppy disks. A floppy disk is like a small record. It slots into the disk drive.

A printer is a machine which prints computer information onto paper. Some printers can print pictures as well as words.

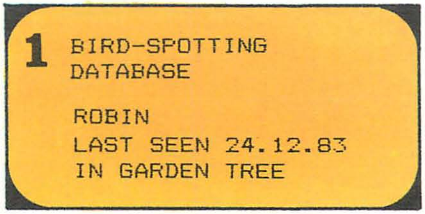
A cassette recorder is for saving and loading programs on cassettes.

Interfaces

Most peripherals use electrical signals which are different from the computer's. To make the computer and peripheral understand one another a special device called an interface is needed. The interface changes the peripheral's signals into computer signals.

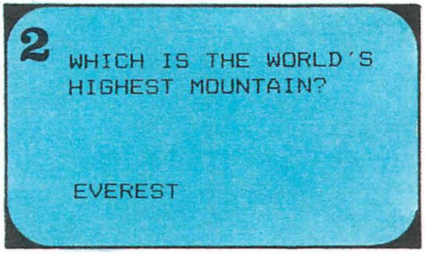


Useful programs



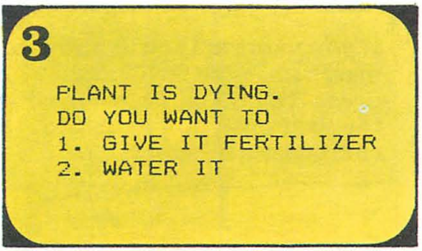
```
1  BIRD-SPOTTING
   DATABASE

   ROBIN
   LAST SEEN 24.12.83
   IN GARDEN TREE
```

A database program enables you to store lots of information and use your computer to organize it. The computer can search through the database and find any piece of information in a fraction of a second.



```
2
   WHICH IS THE WORLD'S
   HIGHEST MOUNTAIN?


   EVEREST
```

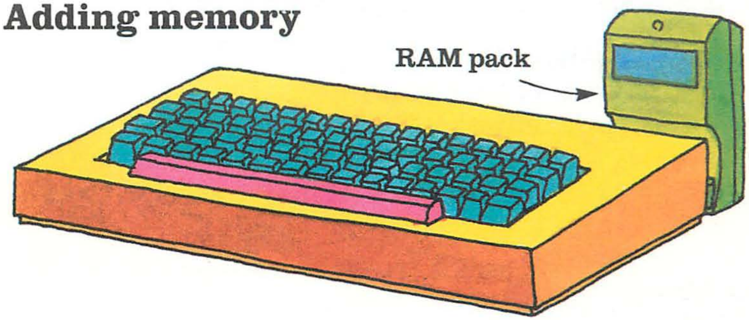
You can buy programs to test your maths or spelling, or your knowledge of a subject such as geography or French.



```
3

  PLANT IS DYING.
  DO YOU WANT TO
  1. GIVE IT FERTILIZER
  2. WATER IT
```

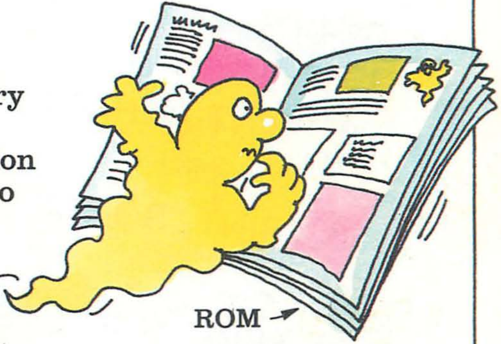
Simulations are programs which recreate real-life situations. Simulations are very useful for teaching people new skills.

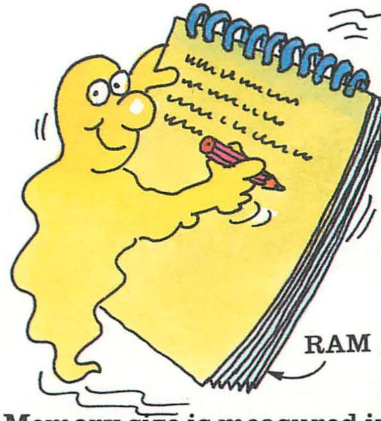
Adding memory



A computer has two kinds of memory, one called ROM and one called RAM. Programs are stored in the RAM and you can buy an extra RAM pack if you want to store very long programs.

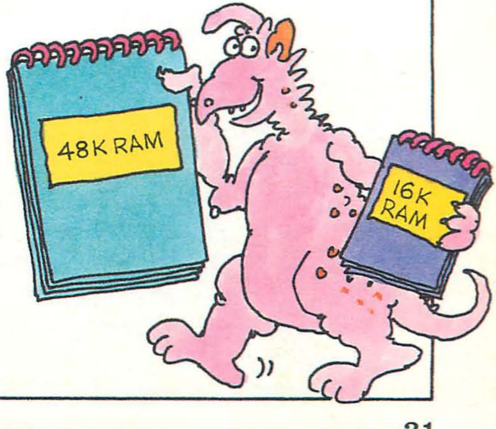
►ROM is short for Read Only Memory. This memory is like an instruction manual. It holds information telling the computer how to work.





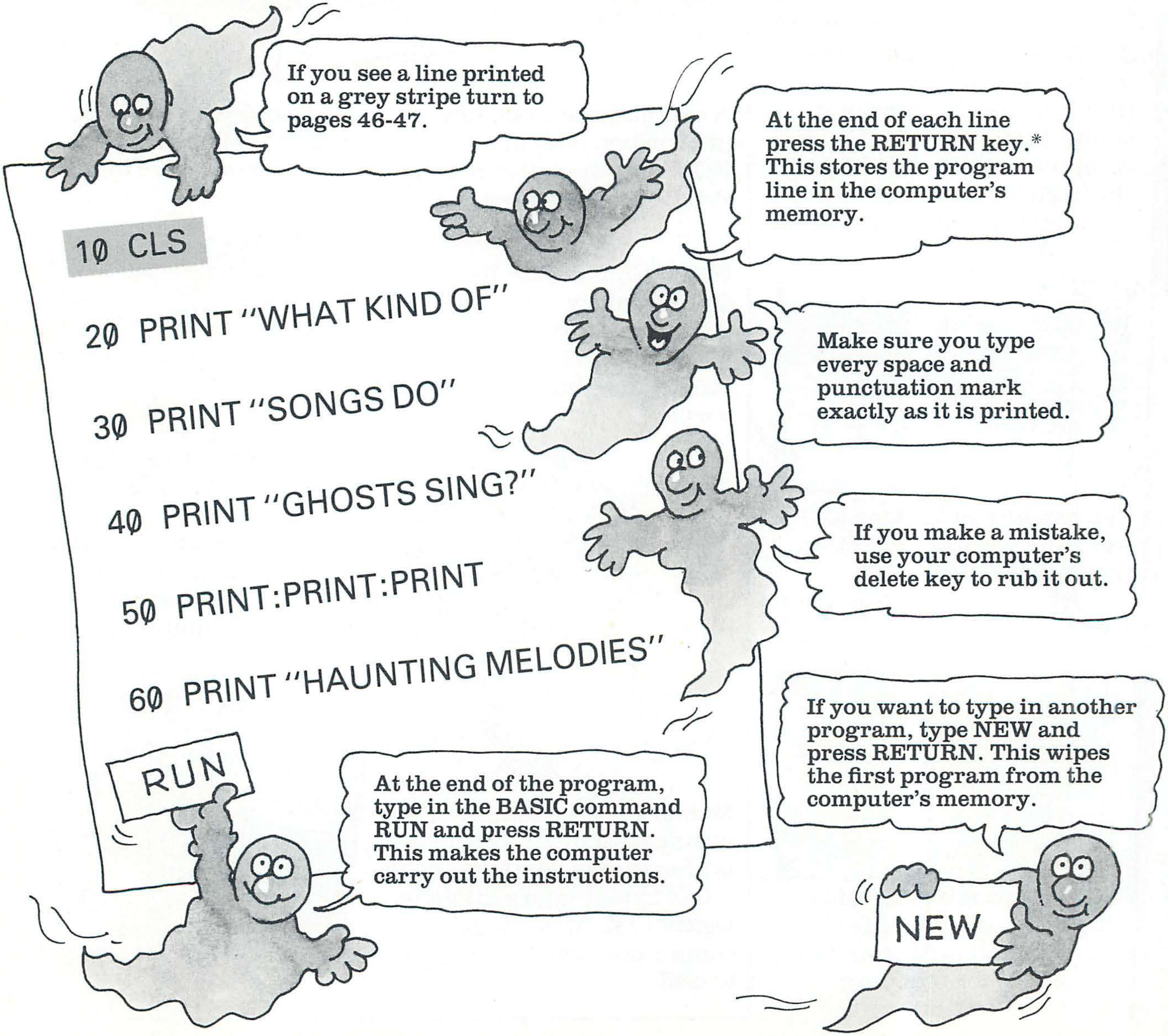
◄RAM is short for Random Access Memory. You can think of it as a notepad where the computer stores programs.

Memory size is measured in units called bytes. One byte is one piece of computer code. 1,024 bytes make a kilobyte, written 1K. Most home computers have RAMs of up to 48K.



Hints on typing in programs

On the next few pages there are some programs to try on a home computer. The programs are written to run on Commodore 64, VIC 20, BBC, Electron, Spectrum and Apple computers. Some program lines vary from one computer to another. These lines are printed on grey stripes, and conversion lines for different computers are given on pages 46-47.



```
10 CLS

20 PRINT "WHAT KIND OF"

30 PRINT "SONGS DO"

40 PRINT "GHOSTS SING?"

50 PRINT:PRINT:PRINT

60 PRINT "HAUNTING MELODIES"
```

If you see a line printed on a grey stripe turn to pages 46-47.

At the end of each line press the RETURN key.* This stores the program line in the computer's memory.

Make sure you type every space and punctuation mark exactly as it is printed.

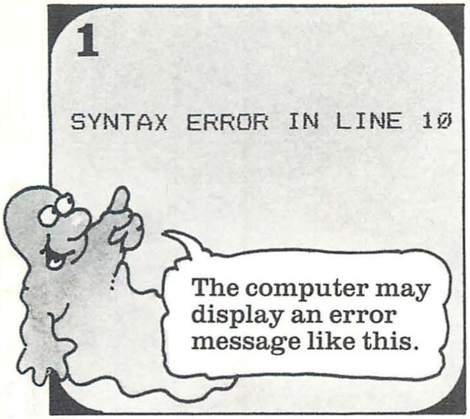
If you make a mistake, use your computer's delete key to rub it out.

At the end of the program, type in the BASIC command RUN and press RETURN. This makes the computer carry out the instructions.

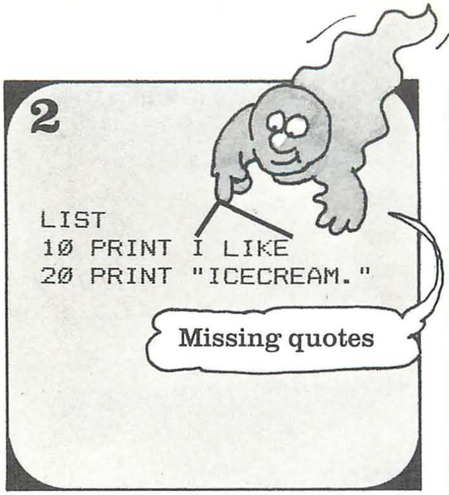
If you want to type in another program, type NEW and press RETURN. This wipes the first program from the computer's memory.

***If your computer has an ENTER key press it each time you are told to press RETURN in this book.**

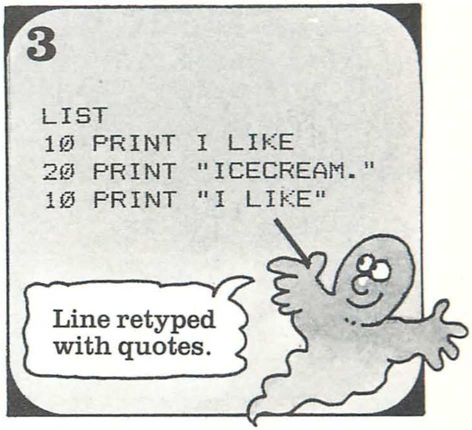
Bugs in programs


1
The computer may display an error message like this.

```
SYNTAX ERROR IN LINE 10
```



```
LIST
10 PRINT I LIKE
20 PRINT "ICECREAM."
```



```
LIST
10 PRINT I LIKE
20 PRINT "ICECREAM."
10 PRINT "I LIKE"
```

If a program does not work you have probably made a typing mistake. Mistakes in programs are called bugs.

To find a bug, first type LIST and press RETURN. This puts the program lines on the screen. Check each one carefully. If you spot a mistake you can correct it by typing the whole line again, including the line number.

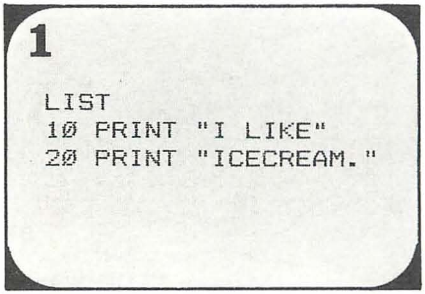
Stopping programs

Commodore 64 and VIC 20	RUN STOP
BBC and Electron	ESCAPE
Spectrum	CAPS SHIFT + BREAK SPACE Press keys together.
Apple	CTRL + C Press keys together.

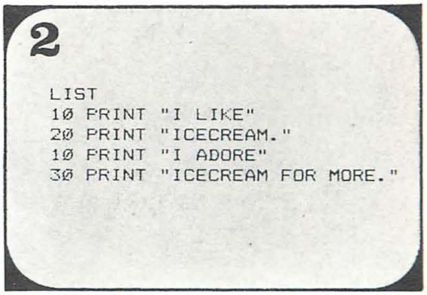
Some programs carry on running until you stop them. Above you can see which keys to press to stop a program.

Changing programs

In this book there are some suggestions for improving the programs by adding or changing lines. You can find out how to do this below.



```
LIST
10 PRINT "I LIKE"
20 PRINT "ICECREAM."
```



```
LIST
10 PRINT "I LIKE"
20 PRINT "ICECREAM."
10 PRINT "I ADORE"
30 PRINT "ICECREAM FOR MORE."
```

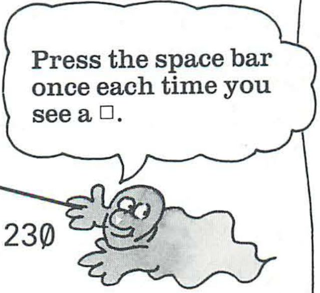
First you need to stop the program, and type CLS (or your computer's word) to clear the screen. Then list the program lines on the screen.

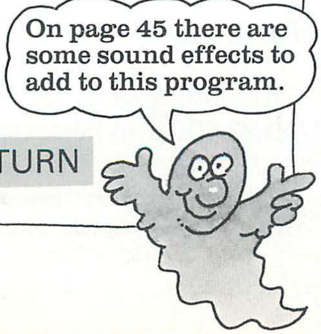
Type in the new lines with their line numbers, as shown here. If you list the program again you will see the computer puts in the new lines in the right places.

Rocket Lift-off program

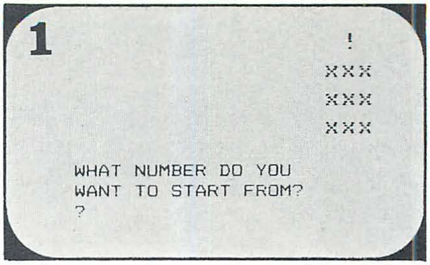
The program on this page makes the computer count down to 1 and then launch a rocket on the screen. When you type in the program remember to check the conversion pages to see if you need to change the lines on grey stripes.

```
 10 CLS
 20 LET X=16:LET Y=20:LET A$="!":GOSUB 230
 30 FOR X=17 TO 19
 40 LET Y=19:LET A$="***":GOSUB 230
 50 NEXT X
 60 PRINT "WHAT NUMBER DO YOU"
 70 PRINT "WANT TO START FROM?"
 80 INPUT Z
 90 FOR C=Z TO 1 STEP -1
100 LET X=5:LET Y=5:LET A$=STR$(C)
110 GOSUB 230
120 FOR V=1 TO 100:NEXT V
130 LET A$="□□□":GOSUB 230
140 NEXT C
150 LET Y=1
160 LET A$="LIFT-OFF!":GOSUB 230
170 FOR X=16 TO 2 STEP -1
180 LET Y=20:LET A$="!":GOSUB 230
190 FOR S=1 TO 30:NEXT S
200 LET A$="□":GOSUB 230
210 NEXT X
220 STOP
230 PRINT TAB (Y,X); A$; "□":RETURN
```


Press the space bar once each time you see a □.

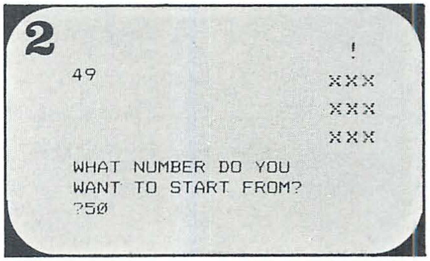

On page 45 there are some sound effects to add to this program.

Running the program



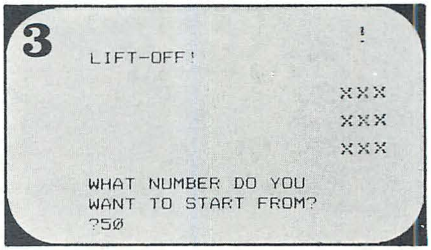
```
                                  !
                                 XXX
                                 XXX
                                 XXX

    WHAT NUMBER DO YOU
    WANT TO START FROM?
    ?
```

When you type RUN the computer puts a rocket and launch pad on the screen. Then it asks you what number you want the countdown to start from.



```
                                  !
    49                           XXX
                                 XXX
                                 XXX
    WHAT NUMBER DO YOU
    WANT TO START FROM?
    ?50
```

Choose any number you like, type it in and press RETURN. Then the computer starts the countdown.

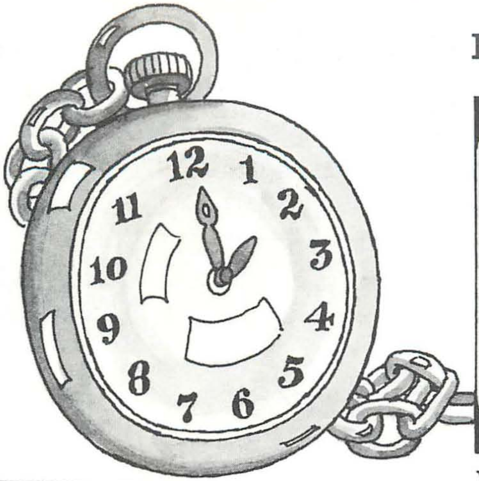


```
                                  !
     LIFT-OFF!

                                 XXX
                                 XXX
                                 XXX

     WHAT NUMBER DO YOU
     WANT TO START FROM?
     ?50
```

When the computer reaches 1, the rocket is launched. If you want to run the program again type RUN.

Seconds

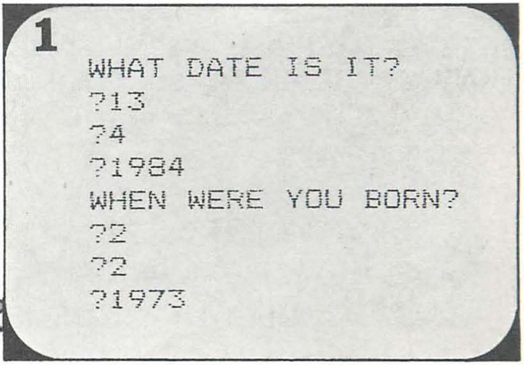
This program makes a computer calculate the number of seconds you have been alive. Before you run the program, see if you can guess how old you are in seconds.



```
10 CLS:DIM N(12)
20 FOR K=1 TO 12:READ N(K):NEXT K
30 PRINT "WHAT DATE IS IT?"
40 INPUT D1,M1,Y1
50 PRINT "WHEN WERE YOU BORN?"
60 INPUT D2,M2,Y2: LET D=D1-D2
70 LET M=M1-M2:LET Y=Y1-Y2
80 IF D>=0 THEN GOTO 100
90 LET D=D+N(M1):LET M=M-1
100 IF M>=0 THEN GOTO 120
110 LET M=M+12:LET Y=Y-1
120 IF Y/4<>INT(Y/4) THEN GOTO 140
130 IF M1=3 AND M2=2 THEN LET D=D+1
140 LET D=365.25*Y+30.24*M+D
150 LET S=D*24*60*60
160 PRINT "YOU ARE NOW ABOUT"
170 PRINT INT(S/1000000)
180 PRINT "MILLION SECONDS OLD."
190 DATA 31,31,28,31,30,31
200 DATA 30,31,31,30,31,30
```

The program does not work for anyone less than 11 days old.

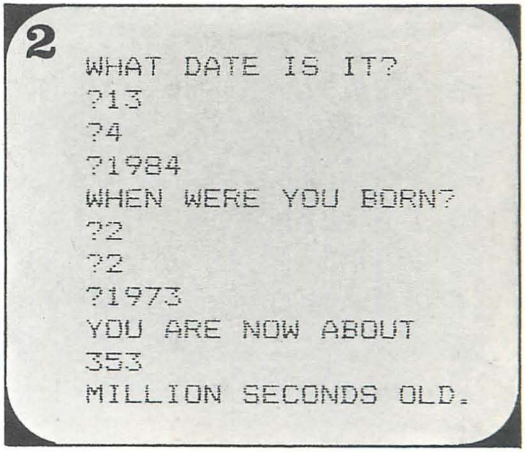
How to use the program



1

```
WHAT DATE IS IT?
?13
?4
?1984
WHEN WERE YOU BORN?
?2
?2
?1973
```

When you run the program the computer asks what date it is. Type the day, month and year as numbers and press RETURN after each one. Then the computer asks for your date of birth. Type it as numbers, in the same way as you did before.



2

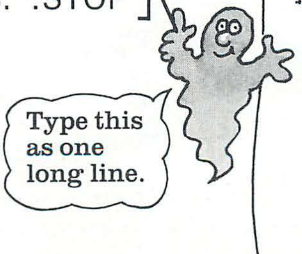
```
WHAT DATE IS IT?
?13
?4
?1984
WHEN WERE YOU BORN?
?2
?2
?1973
YOU ARE NOW ABOUT
353
MILLION SECONDS OLD.
```

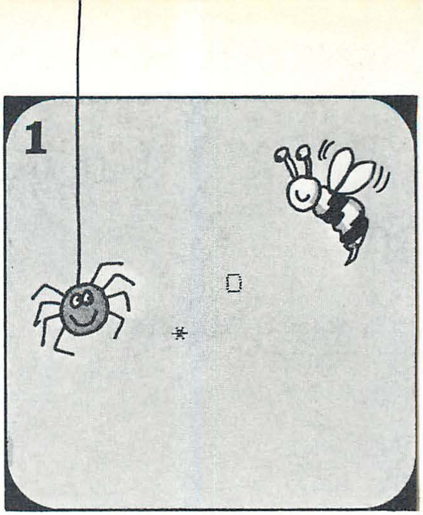
The computer works out how many seconds have passed since the day you were born. The number is only a rough guide because it does not take into account what time you were born, or what time it is now.

Spider and Bee game

This program is for a game to play on a computer. In the game you are a bee and you have to catch a spider which is running over an invisible web on the screen.

```
 10 CLS
 20 LET Y=12:LET X=16
 30 LET Q=12:LET W=16
 40 LET A=X:LET D=Y:GOSUB 240:PRINT "O"
 50 LET A=Q:LET D=W:GOSUB 240:PRINT "*"
 60 LET A$=INKEY$
 70 IF A$<>"" THEN LET A=X:LET D=Y
 80 GOSUB 240:PRINT "□"
 90 IF Y=W AND X=Q AND A$<>"" THEN GOTO 220
100 IF A$="N" THEN LET X=X-1
110 IF A$="M" THEN LET X=X+1
120 IF A$="Z" THEN LET Y=Y+1
130 IF A$="A" THEN LET Y=Y-1
140 LET A=Q:LET D=W:GOSUB 240:PRINT "□"
150 LET R=INT(RND(1)*4)+1
160 IF R=1 AND W>1 THEN LET W=W-1
170 IF R=2 AND W<19 THEN LET W=W+1
180 IF R=3 AND Q>1 THEN LET Q=Q-1
190 IF R=4 AND Q<19 THEN LET Q=Q+1
200 IF Y<1 OR Y>20 OR X<1 OR X>20 THEN
    PRINT "FALLEN FROM THE WEB.":STOP
210 GOTO 40
220 LET A=0:LET D=10:GOSUB 240
230 PRINT "CAUGHT IT!":STOP
240 PRINT TAB(A,D);
250 RETURN
```

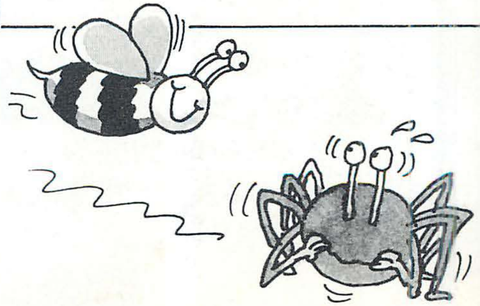

Type this as one long line.

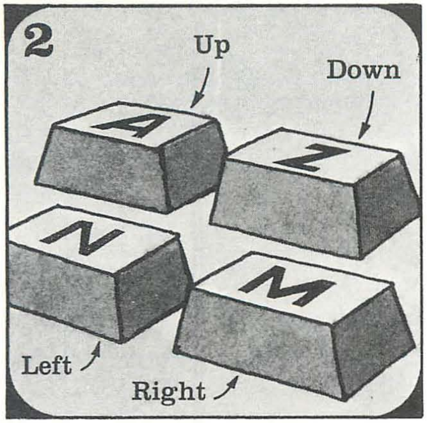


When you run the program, a star and a circle appear on the screen. The star is the spider and the circle is the bee.

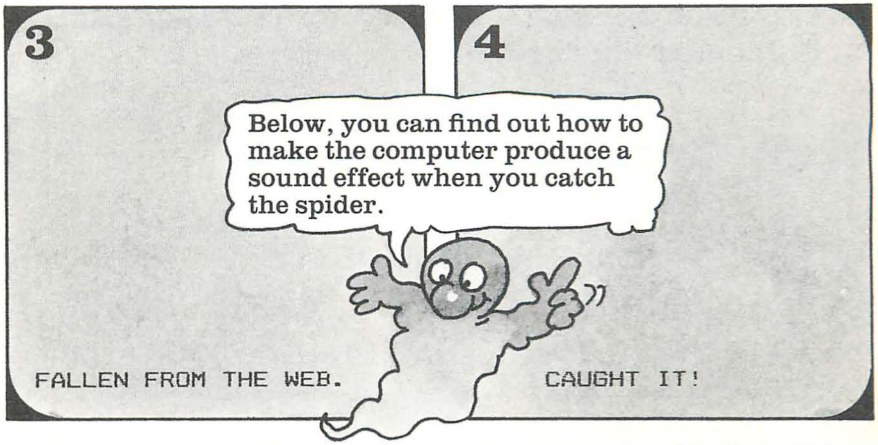
Sound effect

Here are some sound effect lines for the Spider and Bee program. To add the lines, first list the program, and then type them in. The lines are different for each make of computer, so make sure you use the right ones.




2
Up
Down
A
Z
N
M
Left
Right

The spider starts moving about. To catch it you have to move the bee, using the direction keys shown above.

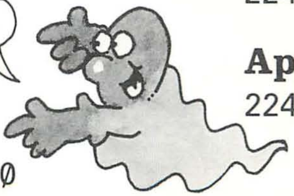

3
4
Below, you can find out how to make the computer produce a sound effect when you catch the spider.
FALLEN FROM THE WEB.
CAUGHT IT!

If the bee falls off the web, the computer stops the game and shows this message on the screen.

The computer displays this message when the bee catches the spider. If you want to play the game again, type **RUN**.

Commodore 64

```
224 POKE 54296,15:POKE 54278,128
226 POKE 54276,33:POKE 54273,34
228 FOR G=1 TO 500:NEXT G:POKE 54276,0
```


On Commodore computers, turn up the TV's volume to hear the sound effect.

VIC 20

```
224 POKE 36878,15:FOR T=1 TO 80
226 POKE 36874,243:NEXT T:POKE 36878,0
```

BBC and Electron

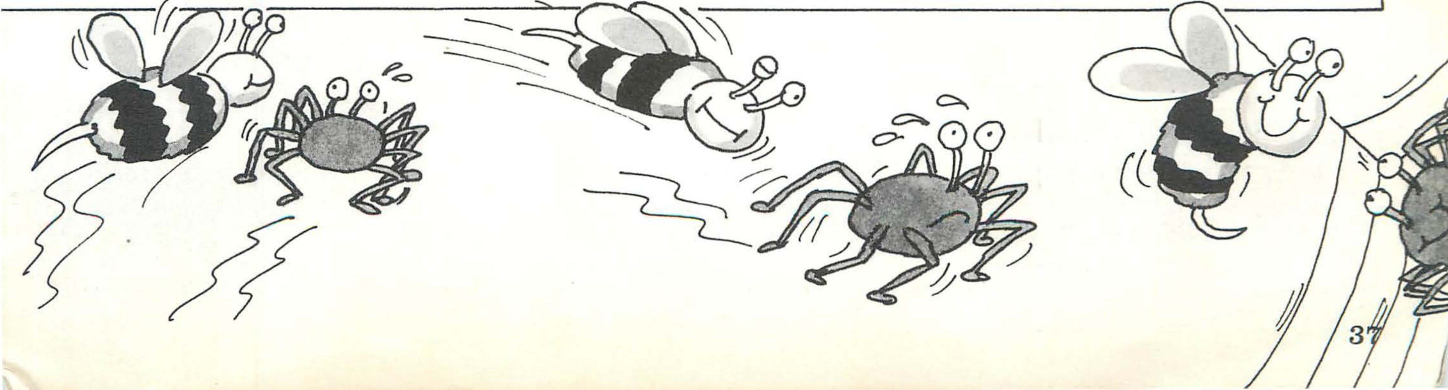
```
224 SOUND 1,-15,75,15
```

Spectrum

```
224 BEEP 1,2
```

Apple

```
224 PRINT CHR$(135)
```

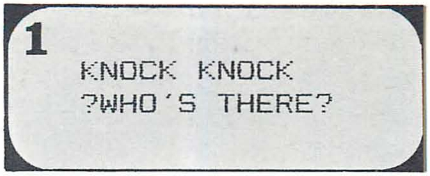


Knock, knock

This is a good program to try on your friends. It makes your computer tell knock-knock jokes.

```
10 DIM A$(8),B$(8)
20 FOR J=1 TO 8:READ A$(J):NEXT J
30 FOR J=1 TO 8:READ B$(J):NEXT J
40 DATA "POLICE", "DOCTOR", "ISOBEL", "AMOS"
50 DATA "ALEC", "JOANNA", "NANA", "ARTHUR"
60 DATA "COME IN", "WHO AND THE DALEKS"
70 DATA "NECESSARY ON A BICYCLE"
80 DATA "QUITO", "TRICIAN", "NICECREAM"
90 DATA "YOUR BUSINESS", "MO"
100 CLS
110 PRINT "KNOCK KNOCK"
120 INPUT N$
130 LET C=INT(RND(1)*8+1)
140 PRINT A$(C)
150 INPUT N$
160 CLS
170 PRINT:PRINT A$(C);"□";B$(C):PRINT
180 INPUT D$:IF D$<>"S" THEN GOTO 100
190 STOP
```

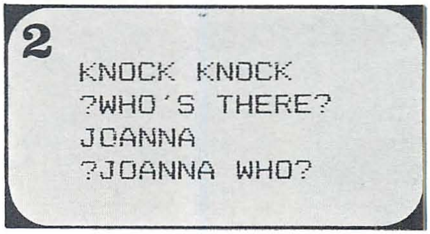
Running the program



1

```
KNOCK KNOCK
?WHO'S THERE?
```

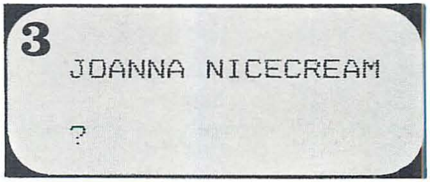
When you run the program the computer displays the words "Knock knock". Type "Who's there?" and press RETURN.



2

```
KNOCK KNOCK
?WHO'S THERE?
JOANNA
?JOANNA WHO?
```

When the computer gives you an answer, type "Who?" again and press RETURN. Then you will find out the punchline.



3

```
JOANNA NICECREAM

?
```

If you want another joke, press RETURN. The computer picks the jokes randomly so you may get the same one twice. To stop press S and then RETURN.

Changing the jokes

You can put new jokes in the program when you get tired of the old ones. To do this you need to retype the DATA lines, putting your new joke instead of one that is there. Make sure you put each part of your joke in the same position as the one you take out.

Code-breaker

This program is for a number game to play on your computer. In the game you are given a secret code which has a number missing. To crack the code you must work out what the number is.

```
 10 LET V=0:LET S=0
 20 FOR P=1 TO 1000:NEXT P
 30 CLS
 40 LET X=INT(RND(1)*9+1)
 50 LET N=0
 60 IF V=10 THEN GOTO 150
 70 PRINT X;"□";X * 2;"□□?□";X * 4:PRINT
 80 INPUT "MISSING NUMBER";P
 90 IF P=X *3 THEN PRINT "GOT IT!":
    LET S=S+1:LET V=V+1:GOTO 20
100 IF N=0 THEN LET N=1:PRINT "NO,
    TRY AGAIN.":GOTO 80
110 PRINT "YOU FAILED."
120 PRINT "THE CODE IS"
130 PRINT X;"□";X*2;"□";X*3;"□";X*4
140 LET V=V+1:GOTO 20
150 PRINT:PRINT "YOU GOT□";S;"□CODES."
160 IF S>7 THEN PRINT "YOU ARE A
    SUPERSPY!"
170 STOP
```

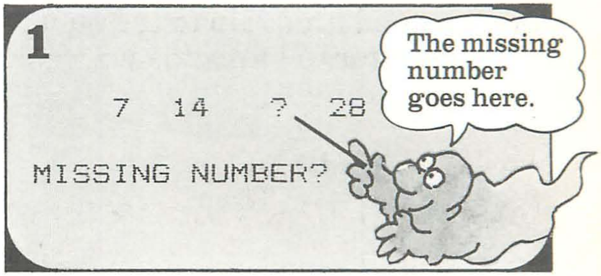
Type this as one long line.

This is one long line.

One long line.

After ten codes the computer stops the game. If you have cracked most of the codes it displays a special message.

How to play

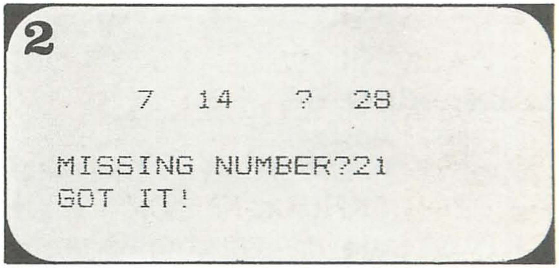


1

```
    7  14   ?  28

MISSING NUMBER?
```

The missing number goes here.

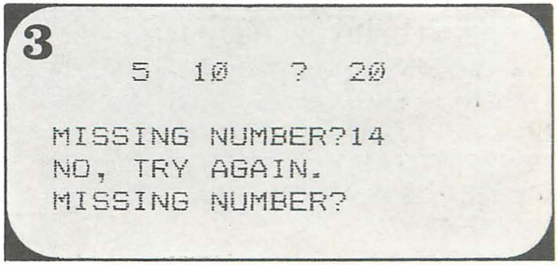
When you run the program the computer displays a row of numbers on the screen. One of the numbers is missing.



2

```
    7  14   ?  28

MISSING NUMBER?21
GOT IT!
```

See if you can work out what the missing number should be. Then type in your answer and press RETURN. If you get the number right, the computer gives you a new code to break.



3

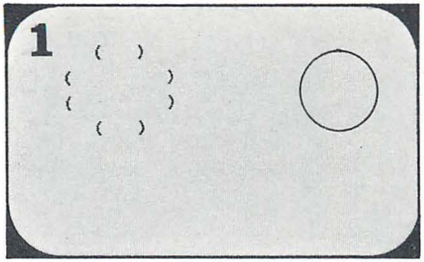
```
    5  10   ?  20

MISSING NUMBER?14
NO, TRY AGAIN.
MISSING NUMBER?
```

If your answer is wrong the computer gives you another attempt to break the code. Then it tells you the answer.

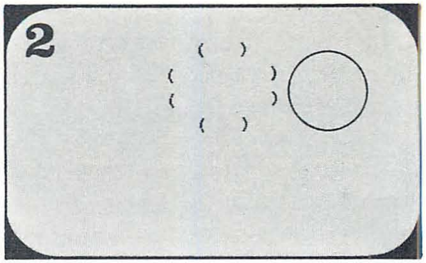
Raincloud

This program makes the computer draw a sun and a cloud on your TV screen. You can move the cloud across the screen and block out the sun. Then, see what happens.

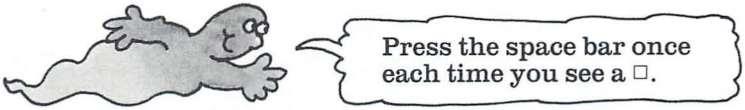
There is a different version of the program for each make of computer, so make sure you type in the right one for yours.



When you run the program the computer draws a sun on one side of the screen and a cloud on the other.

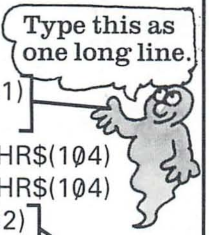


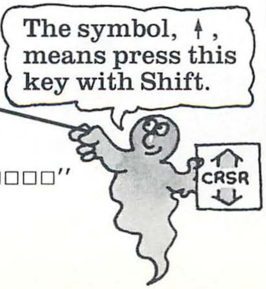
You can move the cloud by pressing any of the letter keys on your computer.


Press the space bar once each time you see a □.

Commodore 64

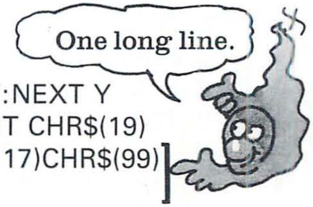
```
 10 PRINT CHR$(147)
 20 PRINT CHR$(30):FOR Y=1 TO 17:PRINT:NEXT Y

 30 PRINT CHR$(158):PRINT CHR$(19)
 40 PRINT TAB(25);CHR$(117)CHR$(101)
    CHR$(101)CHR$(105)
 50 PRINT TAB(25);CHR$(199);"□□";CHR$(104)
 60 PRINT TAB(25);CHR$(199);"□□";CHR$(104)
 70 PRINT TAB(25);CHR$(106)CHR$(102)
    CHR$(102)CHR$(107)
 80 FOR X=0 TO 22
 90 PRINT CHR$(19)CHR$(144)
100 PRINT TAB(X);"□□□(□□)"
110 PRINT TAB(X);"□(□□□□□□)"
120 PRINT TAB(X);"□(□□□□□□)"
130 PRINT TAB(X);"□□□(□□)"
140 GET A$:IF A$="" THEN GOTO 140
150 NEXT X
160 FOR X=1 TO 13
170 PRINT CHR$(159):PRINT"↑";
    TAB(22);"□!□!□!□!□"
180 FOR V=1 TO 200:NEXT V
190 PRINT "↑";TAB(22);"□□□□□□□□□"
200 NEXT X
```

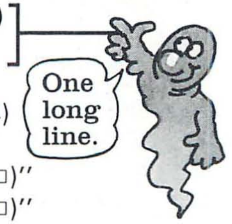

Type this as one long line.
One long line.

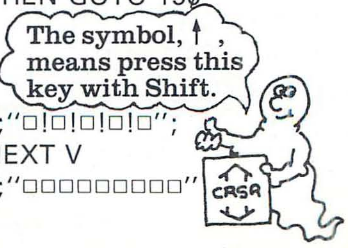

The symbol, ↑, means press this key with Shift.
CRSR

VIC 20

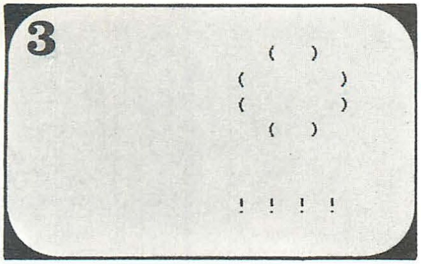
```
 10 PRINT CHR$(147)
 20 PRINT CHR$(30)
 30 FOR Y=1 TO 17:PRINT:NEXT Y
 40 PRINT CHR$(158):PRINT CHR$(19)
 50 PRINT TAB(16);CHR$(117)CHR$(99)
    CHR$(105)
 60 PRINT TAB(16);CHR$(98);"□";CHR$(104)
 70 PRINT TAB(16);CHR$(98);"□";CHR$(104)
 80 PRINT TAB(16);CHR$(106)
    CHR$(102)CHR$(107)
 90 FOR X=0 TO 12
100 PRINT CHR$(19)CHR$(144)
110 PRINT TAB(X);"□□□(□□)"
120 PRINT TAB(X);"□(□□□□□□)"
130 PRINT TAB(X);"□(□□□□□□)"
140 PRINT TAB(X);"□□□(□□)"
150 GET A$:IF A$="" THEN GOTO 150
160 NEXT X
170 FOR X=1 TO 7
180 PRINT CHR$(159)
190 PRINT "↑";TAB(13);"□!□!□!□!□";
200 FOR V=1 TO 200:NEXT V
210 PRINT "↑";TAB(13);"□□□□□□□□□"
220 NEXT X
```


One long line.

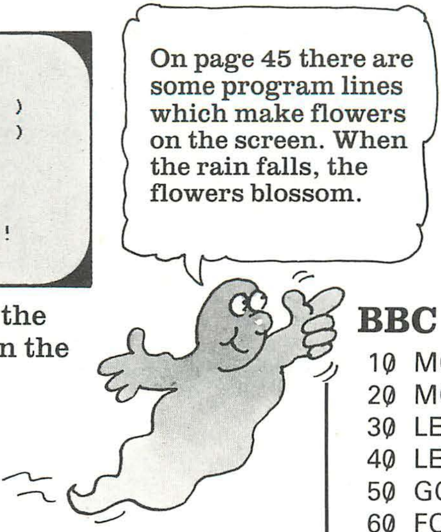

One long line.


The symbol, ↑ , means press this key with Shift.
CRSR

3

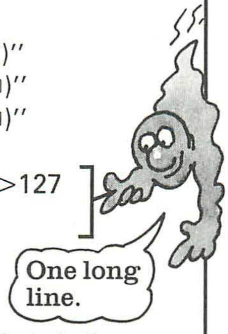


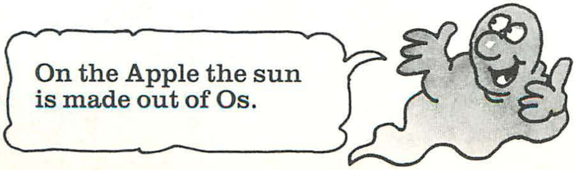
When the cloud covers the sun raindrops fall down the screen, like this.


On page 45 there are some program lines which make flowers on the screen. When the rain falls, the flowers blossom.

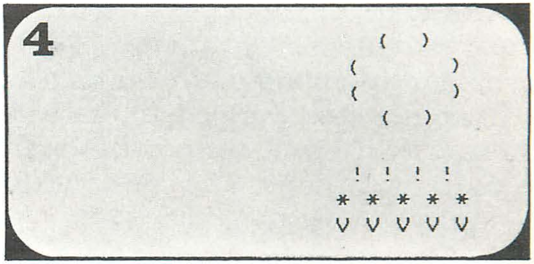
Apple

```
 10 HOME
 20 VTAB 1:HTAB 30:PRINT “OO”
 30 HTAB 29:PRINT “OOOO”
 40 HTAB 29:PRINT “OOOO”
 50 HTAB 30:PRINT “OO”
 60 FOR X=3 TO 28
 70 VTAB 1:HTAB X:PRINT “□(□□)”
 80 HTAB X-2:PRINT “□(□□□□□□)”
 90 HTAB X-2:PRINT “□(□□□□□□)”
100 HTAB X:PRINT “□(□□)”
110 LET G$=“”:IF PEEK (-16384)>127
    THEN GET G$
120 IF G$=“” THEN GOTO 110
130 NEXT X
140 FOR X=5 TO 19
150 HTAB 26:VTAB X:PRINT “□!□!□!□!□”
160 FOR V=1 TO 80:NEXT V
170 HTAB 26:VTAB X:PRINT “□□□□□□□□□”
180 NEXT X
```


One long line.


On the Apple the sun is made out of Os.

4



BBC and Electron*

```
 10 MODE 2
 20 MOVE 1000,948:FOR A=0 TO 360 STEP 10
 30 LET X=58*SIN(RAD(A))+1000
 40 LET Y=58*COS(RAD(A))+890
 50 GCOL 0,3:DRAW X,Y:NEXT A
 60 FOR X=2 TO 12
 70 COLOUR 7:PRINT TAB(X,2);“□(□)”
 80 PRINT TAB(X-1,3);“□(□□□)”
 90 PRINT TAB(X-1,4);“□(□□□)”
100 PRINT TAB(X,5);“□(□)”
110 LET G$=INKEY$(1):IF G$=“” THEN GOTO 110
120 NEXT X
130 FOR X=7 TO 28
140 COLOUR 6:PRINT TAB(10,X);“□!□!□!□!□”
150 FOR V=1 TO 80:NEXT V
160 PRINT TAB(10, X);“□□□□□□□□□”
170 NEXT X
```

Spectrum

```
 10 CIRCLE INK 6;220,150,13
 20 FOR X=5 TO 25
 30 PRINT AT 0,0
 40 PRINT TAB X;“(□□)”
 50 PRINT TAB X-2;“(□□□□□□)”
 60 PRINT TAB X-2;“(□□□□□□)”
 70 PRINT TAB X;“(□□)”
 80 PAUSE 0:NEXT X
 90 FOR X=5 TO 20
100 PRINT AT X,23; INK 5;“□!□!□!□!□”
110 FOR V=1 TO 50:NEXT V
120 PRINT AT X,23;“□□□□□□□□□”
130 NEXT X
```

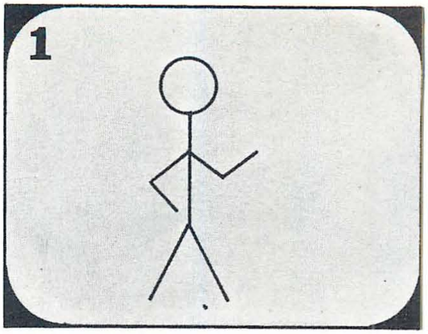
---

*When you have finished with this program type MODE 7 to get normal letters on the screen.

Graphics program

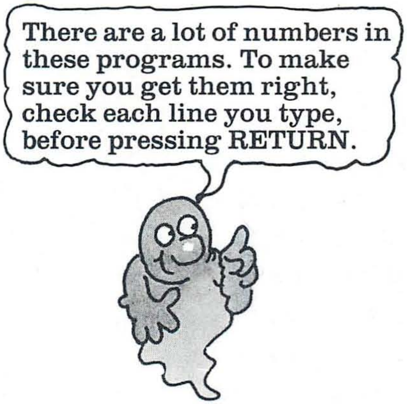
Here and on the next two pages there is a graphics program to try on your computer. It draws a stickman in colour and makes him bounce a ball.

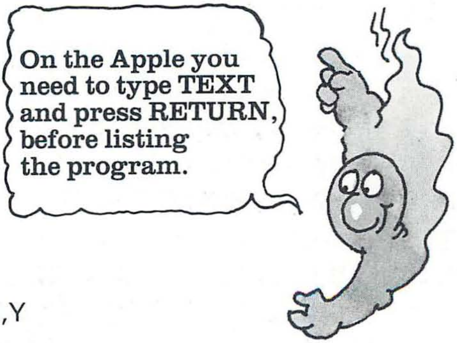
Graphics commands vary between computers, so there is a different version of the program for each make of computer. The version for the Commodore 64 and VIC 20 is over the page.

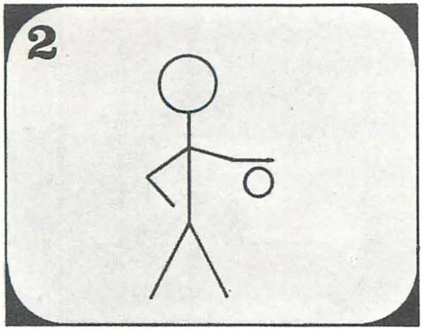


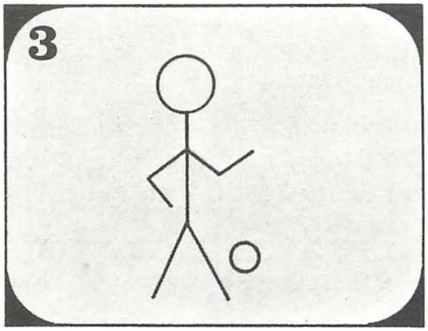
Apple

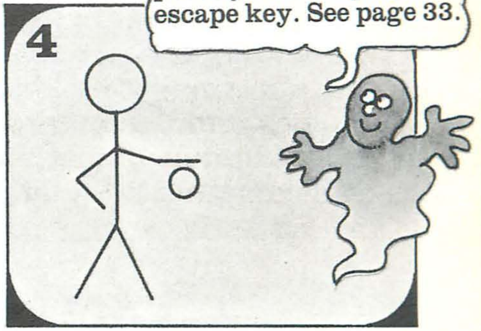
```
10 HGR:HOME
20 HCOLOR=1
30 HPLOT 80,130 TO 95,100 TO 110,130
40 HPLOT 95,100 TO 95,60
50 K=3.14/180
60 FOR A=20 TO 360 STEP 20
70 HPLOT TO 95+10*SIN(A*K),50+10*COS(A*K)
80 NEXT A
90 HPLOT 89,90 TO 79,75 TO 95,60 TO 111,75 TO 121,61
100 HCOLOR=0:HPLOT 111,75 TO 121,61
110 HCOLOR=1:HPLOT 111,75 TO 121,75
120 HCOLOR=2:X=120:Y=80
130 GOSUB 220:GOSUB 210
140 HCOLOR=0:GOSUB 220
150 HPLOT 111,75 TO 125,75
160 HCOLOR=1:HPLOT 111,75 TO 121,61
170 HCOLOR=2:X=120:Y=125
180 GOSUB 220:GOSUB 210
190 HCOLOR=0:GOSUB 220
200 GOTO 100
210 FOR T=1 TO 100:NEXT T:RETURN
220 HPLOT X,Y  TO X+5, Y  TO X+5,Y+5  TO X,Y+5  TO X,Y
230 RETURN
```


There are a lot of numbers in these programs. To make sure you get them right, check each line you type, before pressing RETURN.


On the Apple you need to type TEXT and press RETURN, before listing the program.







To stop the program press your computer's escape key. See page 33.

BBC and Electron

```
10 MODE 2
20 MOVE 300,300
30 GCOL 0,1:DRAW 400,500
40 DRAW 500,300
50 DRAW 400,500
60 DRAW 400,700
70 DRAW 275,600
80 DRAW 350,550
90 MOVE 400,700
100 DRAW 525,600
110 DRAW 600,650
120 MOVE 400,800
130 FOR A=1 TO 360 STEP 10
140 X=50*SIN(RAD(A))+400:Y=50*COS(RAD(A))+750
150 DRAW X,Y:NEXT A:REPEAT
160 GCOL 0,0:MOVE 525,600:DRAW 600,650
170 GCOL 0,1:MOVE 525,600:DRAW 600,600
180 PRINT TAB(9,14);"O":GOSUB 250
190 PRINT TAB(9,14);"□"
200 GCOL 0,0:MOVE 525,600:DRAW 600,600
210 GCOL 0,1:MOVE 525,600:DRAW 600,650
220 PRINT TAB(9,22);"O":GOSUB 250
230 PRINT TAB(9,22);"□"
240 UNTIL FALSE
250 FOR N=1 TO 500:NEXT N:RETURN
```

When you have finished with this program type MODE 7 to get normal letters on the screen.

Spectum

```
10 PLOT 80,20
20 INK 2:DRAW 15,30
30 DRAW 15,-30
40 PLOT 95,50
50 DRAW 0,40
60 DRAW -16,-16
70 DRAW 10,-14
80 PLOT 95,90
90 DRAW 16,-16
100 DRAW 10,14
110 CIRCLE 95,100,10
120 INK 2:PLOT 111,74
130 DRAW INVERSE 1;10,14
140 PLOT 111,74:DRAW 14,0
150 INK 6:PRINT AT 13,15;"O":GOSUB 230
160 PRINT AT 13,15;"□"
170 INK 2:PLOT 111,74
180 DRAW INVERSE 1;14,0
190 PLOT 111,74:DRAW 10,14
200 INK 6:PRINT AT 18,15; "O":GOSUB 230
210 PRINT AT 18,15;"□"
220 GOTO 120
230 FOR N=1 TO 100:NEXT N:RETURN
```

After you stop the program, the listing is yellow or red.

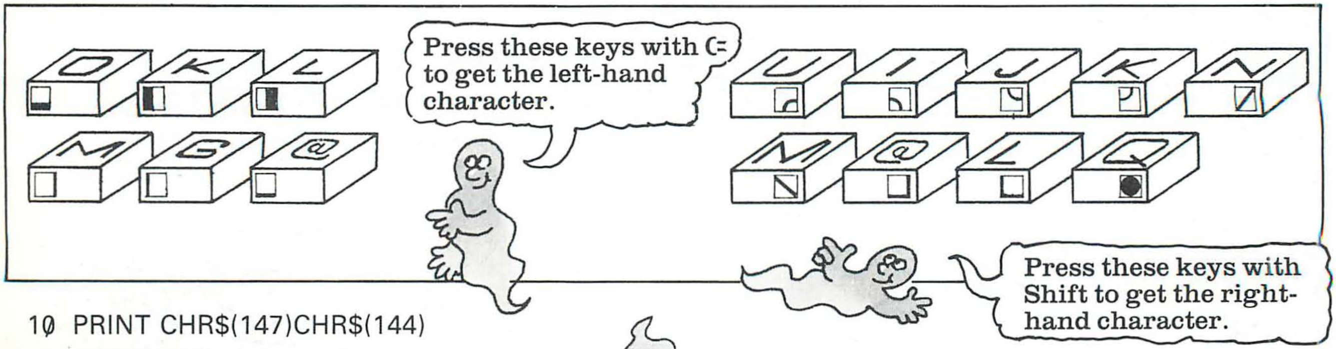
To make the letters black again, type INK 0 and press ENTER.

Press the Spectrum's RETURN key here.

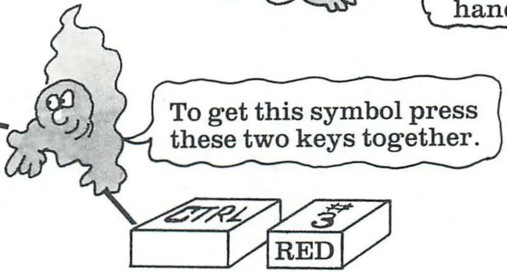
Commodore 64 and VIC 20

On the Commodore 64 and VIC 20 the stickman is made from symbols on the front of the computer keys. These symbols are called graphics characters. To get the right-hand character on a key, you press it with the Shift key. To get the left-hand character on a key, you press it with the key marked C= .

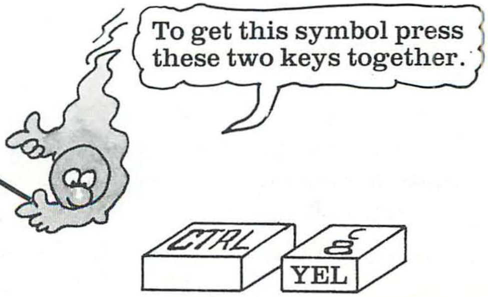
Below you can see the graphics characters used in this program, and the keys they are on.


Press these keys with C= to get the left-hand character.
O
K
L
M
G
@
U
I
J
K
N
M
@
L
Q
Press these keys with Shift to get the right-hand character.

```
10 PRINT CHR$(147)CHR$(144)
20 PRINT TAB(8);"£╭╮"
30 PRINT TAB(8);"╰╯"
40 PRINT TAB(8);"▄▄"
50 PRINT TAB(7);"╱◨◧╲╱"
60 PRINT TAB(6);"□╲◨◧"
70 PRINT TAB(8);"◨◧"
80 PRINT TAB(8);"◨◧"
90 PRINT TAB(8);"╱╲"
100 PRINT TAB(7);"▕□□▏"
110 PRINT TAB(7);"▕□□▏"
120 PRINT TAB(7);"▕□□▏"
130 LET N=4:GOSUB 220:PRINT TAB (12);"□"
140 LET N=10:GOSUB 220:PRINT TAB(12);"π●"
150 LET N=3:GOSUB 220:PRINT TAB(11);"£╱"
160 FOR T=1 TO 300:NEXT T
170 LET N=3:GOSUB 220:PRINT TAB(11);"£▁"
180 LET N=10:GOSUB 220:PRINT TAB(12);"□"
190 LET N=4:GOSUB 220:PRINT TAB(12);"π●"
200 FOR T=1 TO 300:NEXT T
210 GOTO 130
220 PRINT CHR$(19):FOR R=1 TO N:PRINT:NEXT R:RETURN
```


To get this symbol press these two keys together.
CTRL
3
RED

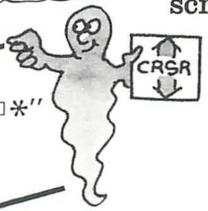
The symbol, □ , means type a space.


To get this symbol press these two keys together.
CTRL
8
YEL

Making flowers

Below there are program lines which add flowers to the Raincloud program on pages 40-41. Before adding the lines you must type in the whole of the original program.

Commodore 64


The symbol, ↑, means press this key with Shift.
CRSR

```
 25 PRINT TAB(22);"V□V□V□V□V"
210 PRINT CHR$(156)
220 PRINT TAB(22);" ↑ ";"*□*□*□*□*"
```

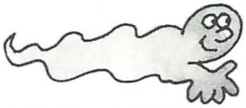
VIC 20

```
 35 PRINT TAB(13);"V□V□V□V□V"
230 PRINT CHR$(156)
240 PRINT TAB(13);"↑↑↑";"*□*□*□*□*'
```

Apple

```
 15 VTAB 20:HTAB 26:PRINT "V□V□V□V□V"
185 VTAB 19:HTAB 26:PRINT "*□*□*□*□*'
```

BBC and Electron


Type MODE 7 before listing the program to add these lines.

```
 15 COLOUR 2:PRINT TAB(10,29);"V□V□V□V□V"
180 COLOUR 5:PRINT TAB(10,28);"*□*□*□*□*"
```

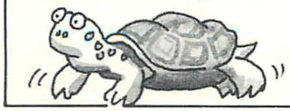
Spectrum

```
  5 PRINT AT 21,23;INK 4;"V□V□V□V□V"
150 PRINT AT 20,23;INK 2;"*□*□*□*□*'
```

Turtle puzzle

These are the commands you need to give the turtle to make it draw the diamond shape.

FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50

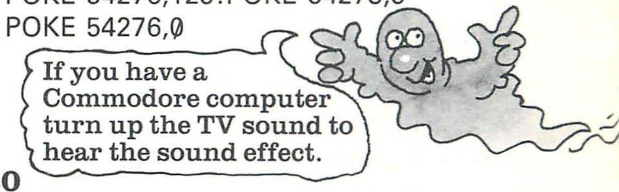


Rocket Lift-off sound effects

The program lines below make the computer play notes as it does the countdown. Then it makes a blast-off sound when the rocket is launched. On the Commodore 64, VIC 20 and Spectrum the sound effect only works if you start the countdown from below a certain number. The number is shown on the screen.

Commodore 64

```
 70 PRINT "TO START FROM (1 TO 68)?"
 95 POKE 54296,15:POKE 54278,64
 96 POKE 54276,17:POKE 54273,50+C*3
125 POKE 54276,0
185 POKE 54276,129:POKE 54273,5
215 POKE 54276,0
```


If you have a Commodore computer turn up the TV sound to hear the sound effect.

VIC 20

```
 70 PRINT "TO START FROM (1 TO 63)?"
 95 POKE 36878,15:POKE 36876,128+C*2
125 POKE 36876,0
185 POKE 36877,200
215 POKE 36877,0
```

Apple

```
105 PRINT CHR$(135)
175 FOR S=1 TO 5:N=PEEK(-16336):NEXT S
185 FOR S=1 TO 5:N=PEEK(-16336):NEXT S
190
```

This deletes line 190.

BBC and Electron

```
105 SOUND 1,-15,100+C*2,3
185 SOUND 0,-15,5,3
```

Spectrum

```
 70 PRINT "TO START FROM (1 TO 49)?"
105 BEEP .1,20+C:BEEP .1,C
185 BEEP .05,25-X
190
```

This deletes line 190.

Program conversions

Here are the lines to type instead of the ones on grey stripes. To find a conversion line look under the section for your computer and find the name of the program you are typing. The conversion line has the same line number as the one on the grey stripe. If there is no conversion line for your computer you can type the line on the grey stripe just as it is.

Commodore 64

Pages 10 and 32

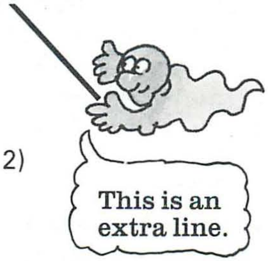
Joke

```
10 PRINT CHR$(147)
```

Page 34

Rocket Lift-off

```
 10 PRINT CHR$(147)
120 FOR V=1 TO 250:NEXT V
150 LET Y=4
190 FOR S=1 TO 70:NEXT S
230 PRINT CHR$(19):FOR L=3 TO X:PRINT:NEXT L
240 PRINT TAB(Y);A$;"□":RETURN
```


This is an extra line.

Page 35

Seconds

```
10 PRINT CHR$(147):DIM N(12)
```

Page 36

Spider and Bee

```
 10 PRINT CHR$(147)
 60 GET A$
240 PRINT CHR$(19):FOR L=1 TO D:PRINT:NEXT L
250 PRINT TAB(A);:RETURN
```

Page 38

Knock, knock

```
100 PRINT CHR$(147)
160 PRINT CHR$(147)
```

Page 39

Code-breaker

```
30 PRINT CHR$(147)
```

VIC 20

Pages 10 and 32

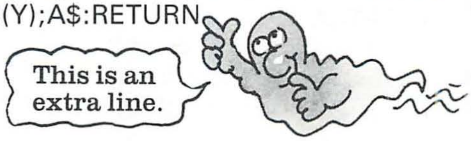
Joke

```
10 PRINT CHR$(147)
```

Page 34

Rocket Lift-off

```
 10 PRINT CHR$(147)
120 FOR V=1 TO 250:NEXT V
150 LET Y=4
170 FOR X=13 TO 2 STEP -1
190 FOR S=1 TO 70:NEXT S
230 PRINT CHR$(19):FOR L=3 TO X:PRINT:NEXT L
240 PRINT TAB(Y);A$:RETURN
```


This is an extra line.

Page 35

Seconds

```
10 PRINT CHR$(147):DIM N(12)
```

Page 36

Spider and Bee

```
 10 PRINT CHR$(147)
 60 GET A$
240 PRINT CHR$(19):FOR L=1 TO D:PRINT:NEXT L
250 PRINT TAB(A);:RETURN
```

Page 38

Knock, knock

```
100 PRINT CHR$(147)
160 PRINT CHR$(147)
```

Page 39

Code-breaker

```
30 PRINT CHR$(147)
```

BBC

On the BBC and Electron you can move the picture down the screen by typing *TV255 and pressing RETURN. Then press BREAK.

Page 34
Rocket Lift-off

```
120 FOR V=1 TO 400:NEXT V
190 FOR S=1 TO 120:NEXT S
```

Page 36
Spider and Bee

```
60 LET A$=INKEY$(1)
```

Electron

Page 34
Rocket Lift-off

```
120 FOR V=1 TO 400:NEXT V
190 FOR S=1 TO 120:NEXT S
```

Page 36
Spider and Bee

```
60 LET A$=INKEY$(1)
```

Page 39
Code-breaker

```
20 FOR P=1 TO 2000:NEXT P
```

Apple

Pages 10 and 32
Joke

```
10 HOME
```

Page 24
Rocket Lift-off

```
 10 HOME
120 FOR V=1 TO 250:NEXT V
190 FOR S=1 TO 70:NEXT S
230 VTAB X:HTAB Y:PRINT A$:RETURN
```

Page 35
Seconds

```
10 HOME:DIM N(12)
```

Page 36
Spider and Bee

```
 10 HOME
 60 LET A$="":IF PEEK(-16384)>127 THEN GET A$
240 HTAB A:VTAB D
250 RETURN
```

Page 38
Knock, knock

```
100 HOME
160 HOME
```

Page 39
Code-breaker

```
30 HOME
```

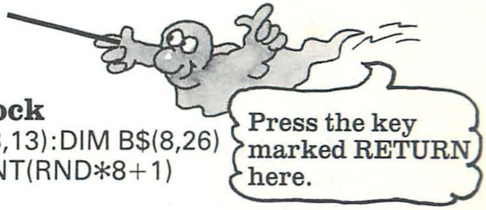
Spectrum

Page 34
Rocket Lift-off

```
230 PRINT AT X,Y;A$:RETURN
```

Page 36
Spider and Bee

```
 10 RANDOMIZE
150 LET R=INT(RND*4)+1
240 PRINT AT D,A;
250 RETURN
```


Press the key marked RETURN here.

Page 38
Knock, knock

```
 10 DIM A$(8,13):DIM B$(8,26)
130 LET C=INT(RND*8+1)
```

Page 39
Code-breaker

```
20 FOR P=1 TO 300:NEXT P
40 LET X=INT(RND*9+1)
```

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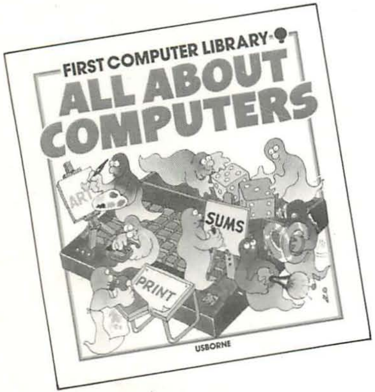
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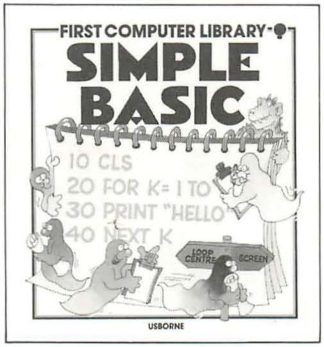
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30 PRINT "HELLO"
40 NEXT K
LOOP CENTRE
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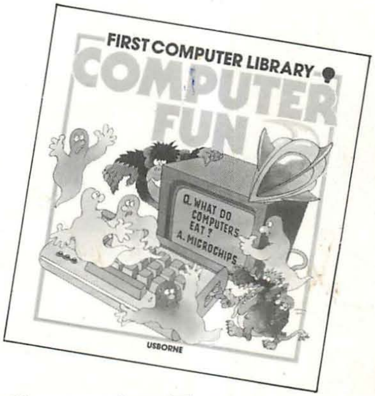
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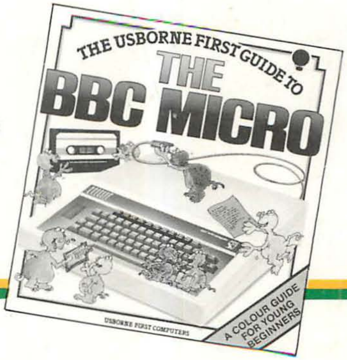
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